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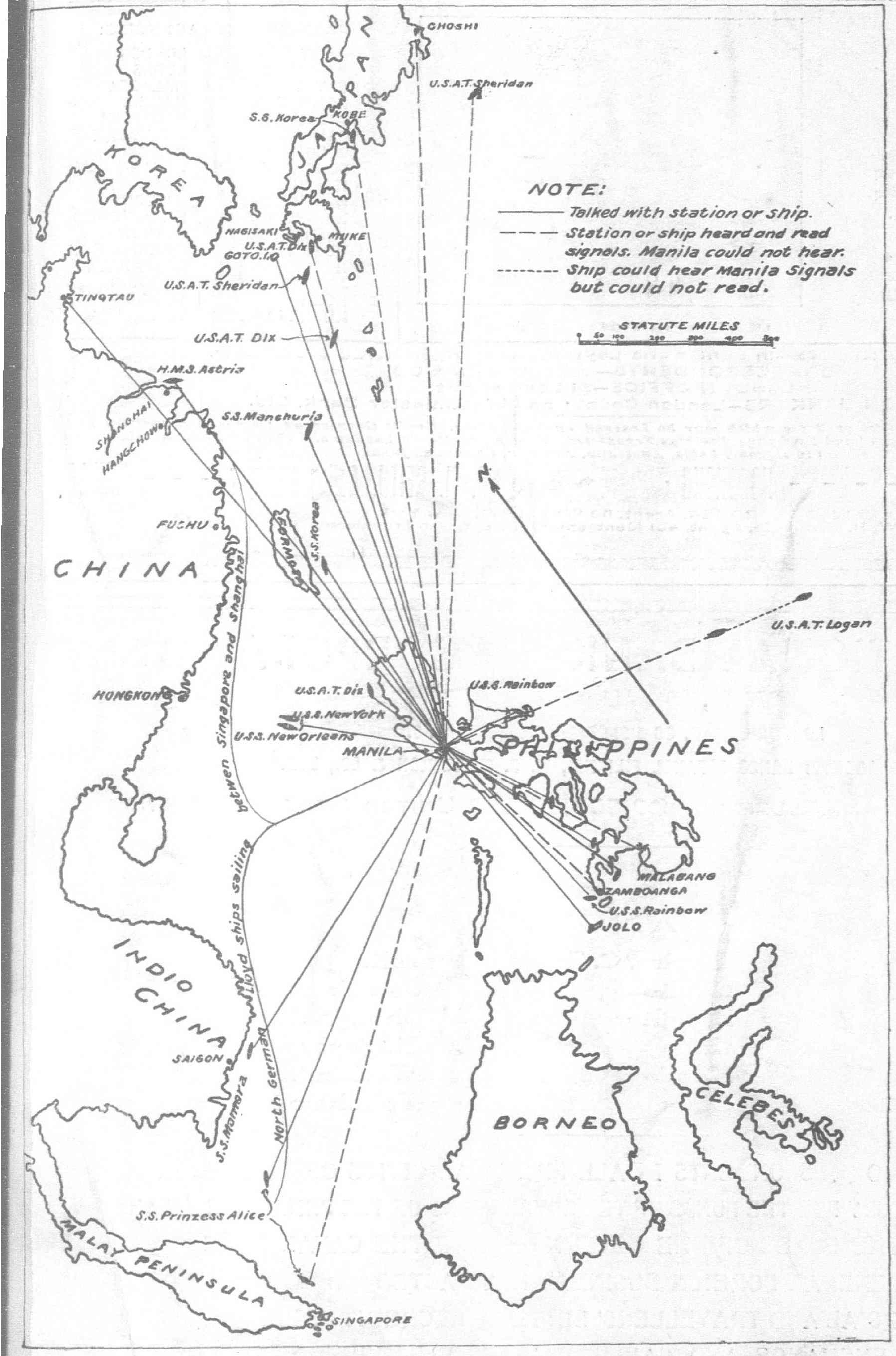

[Prepared by Sergt. J. R. Shettel, Signal Corps, U. S. Army.]

TRANSMISSION RESULTS OBTAINED FROM A 4.6-KILOWATT (PRIMARY ENERGY) WIRELESS TELEGRAPH STATION (TELEFUNKEN SYSTEM) ERECTED BY GERMANN & CO. AT MANILA, P. I., OPERATED UNDER THE DIRECTION OF CAPT. L. D. WILDMAN, SIGNAL CORPS, U. S. ARMY, FOR THE INFORMATION OF THE PHILIPPINES JOINT WIRELESS BOARD.

Development of the South Manchuria Railway Company

* * *

Imperial Taiwan Railways

* * *

Wireless System Proposed for the Philippines

* * *

Tangshan Engineering College

* * *

Philippine Lumber for an Emperor's Mausoleum

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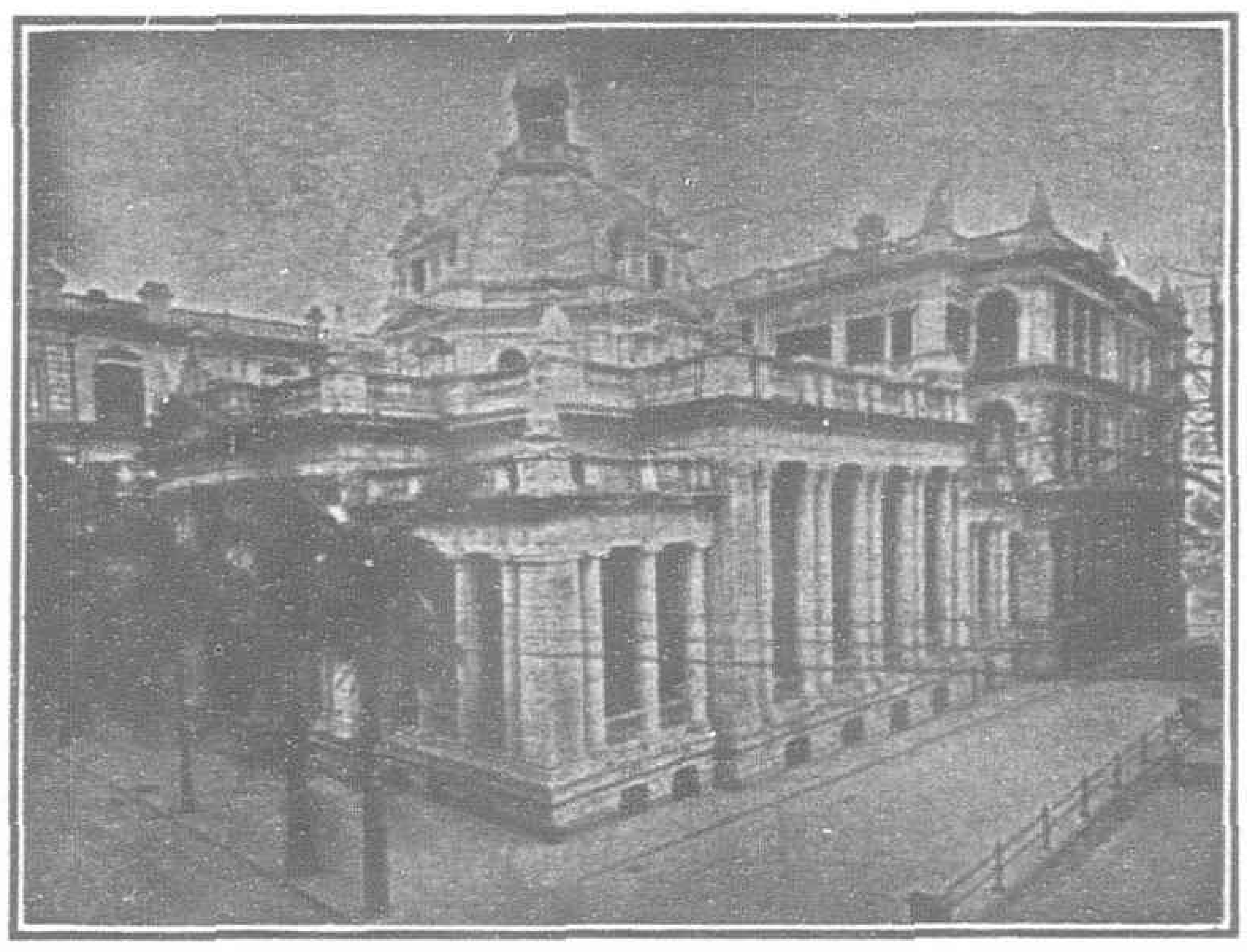

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THE FAR EASTERN REVIEW
COMMERCE ⊛ ENGINEERING ⊛ FINANCE

VOL. VIII. MANILA, P. I., SHANGHAI, AND YOKOHAMA, SEPTEMBER, 1911 No. 4.

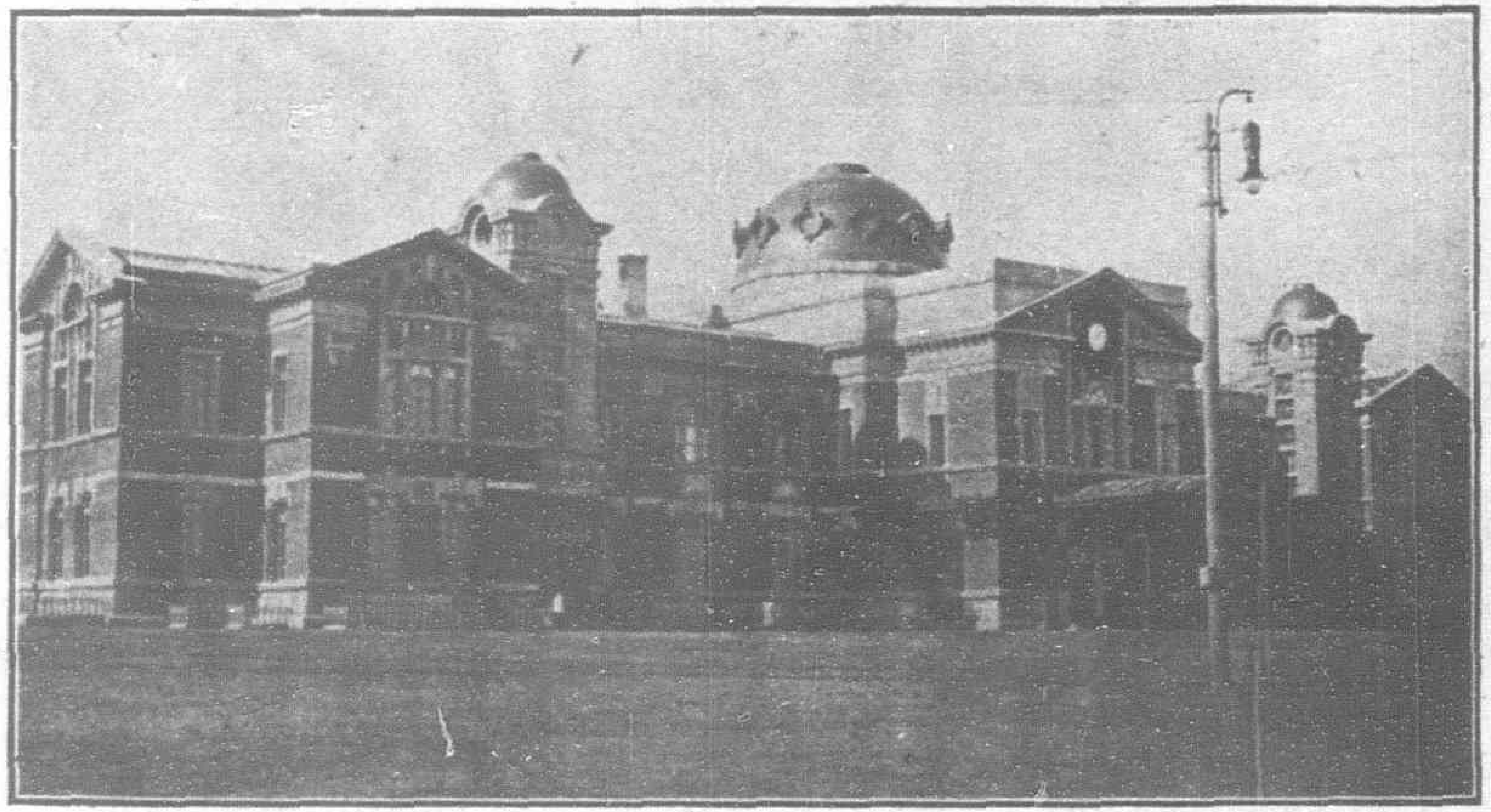
THE DEVELOPMENT OF THE SOUTH MANCHURIA RAILWAY Co.

In August, 1905, the Japanese Government, by virtue of Art. 6 of the Treaty of Peace between Russia and Japan, acquired the Railway main line from Changchun to Port Arthur, together with its branch lines and all the rights, privileges, and properties attaching thereto, including the coal mines formerly owned by the Chinese Eastern Railway. On June 7, 1906, an Imperial Ordinance was issued concerning the establishment of the South Manchuria Railway Company; and on July 13 of the same year General Viscount G. Kodama was appointed President of the Organization Committee, composed of 81 members. But in consequence of the death of Viscount Kodama, which occurred on July 24, Viscount Terauchi, Minister for War, assumed the presidency on July 25. On August 1 the Government forwarded to the Committee the conditions pertaining to the establishment of the South Manchuria Railway Company; and after the formation of the company had been prepared by the committee on the basis of the Imperial Ordinance and in accordance with the conditions of the Government, the Articles of Association were approved by the Government on August 18. The subscription for shares took place from September 10 to October 15; and the establishment of the Company was finally sanctioned by the Minister of Communications on November 1.

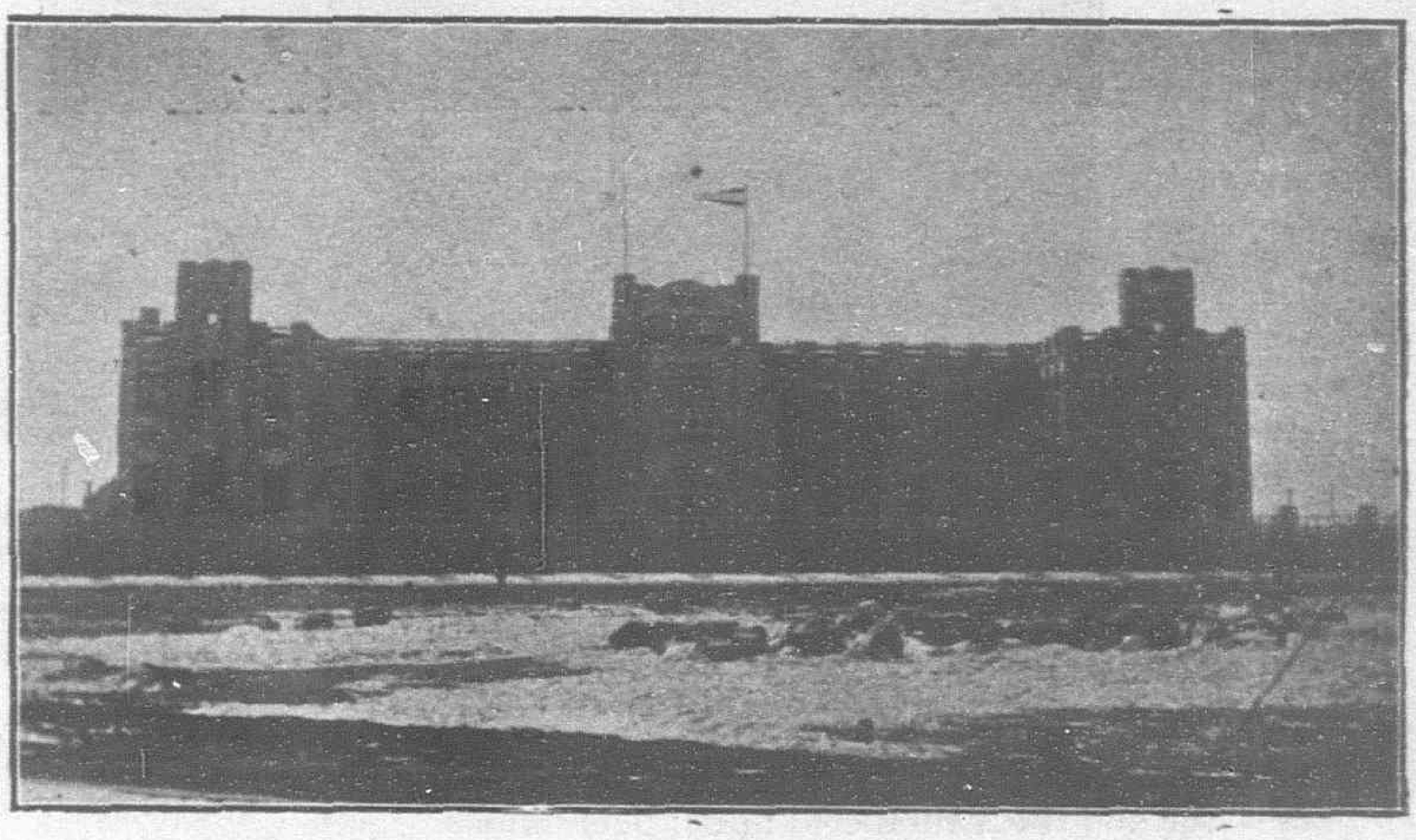
S. M. R. YAMATO HOTEL AT STAR BEACH

The Board of Directors is composed of the following officials: 1 President, 1 Vice-President, and at least 4 Directors; besides whom the Company has from 3 to 5 Auditors.

Both the President and the Vice-President are appointed by the Government with Imperial sanction; the Directors are also appointed by the Government from amongst shareholders owning at least 50 shares; whilst the Auditors are elected at the General Meeting of Shareholders.



S. M. RY. YAMATO HOTEL AND STATION AT MUKDEN

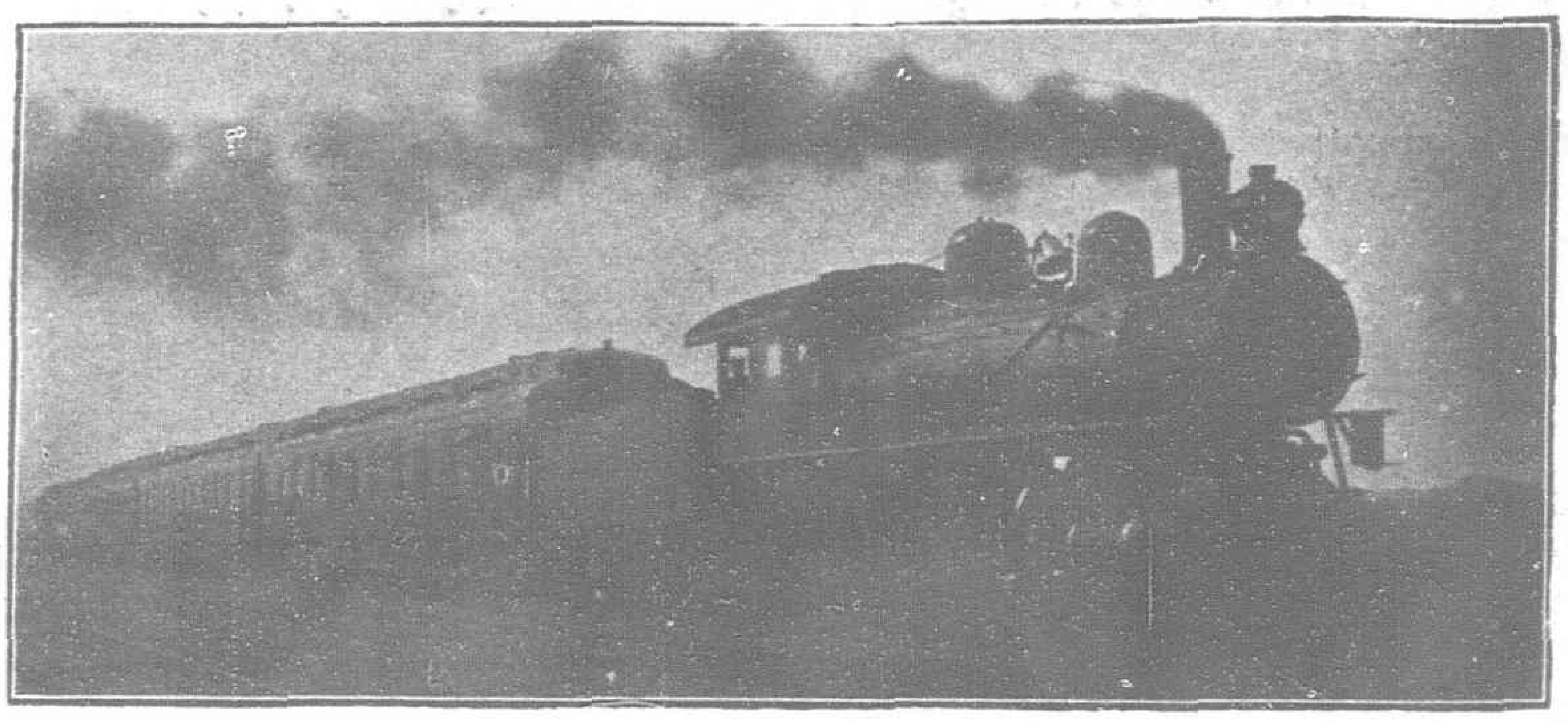


S. M. RY. YAMATO HOTEL AT CHANGCHUN

In accordance with these regulations, on November 13, 1906, Baron S. Goto was appointed President; Mr. Z. Nakamura, Vice President; and Mr. S. Kunisawa and five other gentlemen, Directors of the Company. At the General Meeting, which took place on the same day, Mr. T. Nakahashi and four other shareholders were elected Auditors. On November 27 the President of the Organization Committee handed over all matters connected with the establishment of the Company to the newly-appointed President of the Company; and the registration of the Company was effected on December 7 of the same year. In consequence, however, of the appointment of the President, Baron Goto, to be Minister of Communications, which took place on December 19 following, the Vice-President, Mr. Nakamura, was appointed President, whilst Director Kunisawa was raised to the position of Vice-President.

The Board of Directors at the present time is composed of the following members:—President, Mr. Z. Nakamura; Vice-President, Mr. S. Kunisawa; Directors, Messrs. C. Seino, K. Kubota, N. Inuzuka, S. Tanaka, M. Kubota, Prof. S. Okamatsu, LL. D., and Mr. K. Nonomura; Auditors, Messrs. T. Nakahashi, K. Kawakami, H. Taki, K. Magoshi, and S. Iwashita.

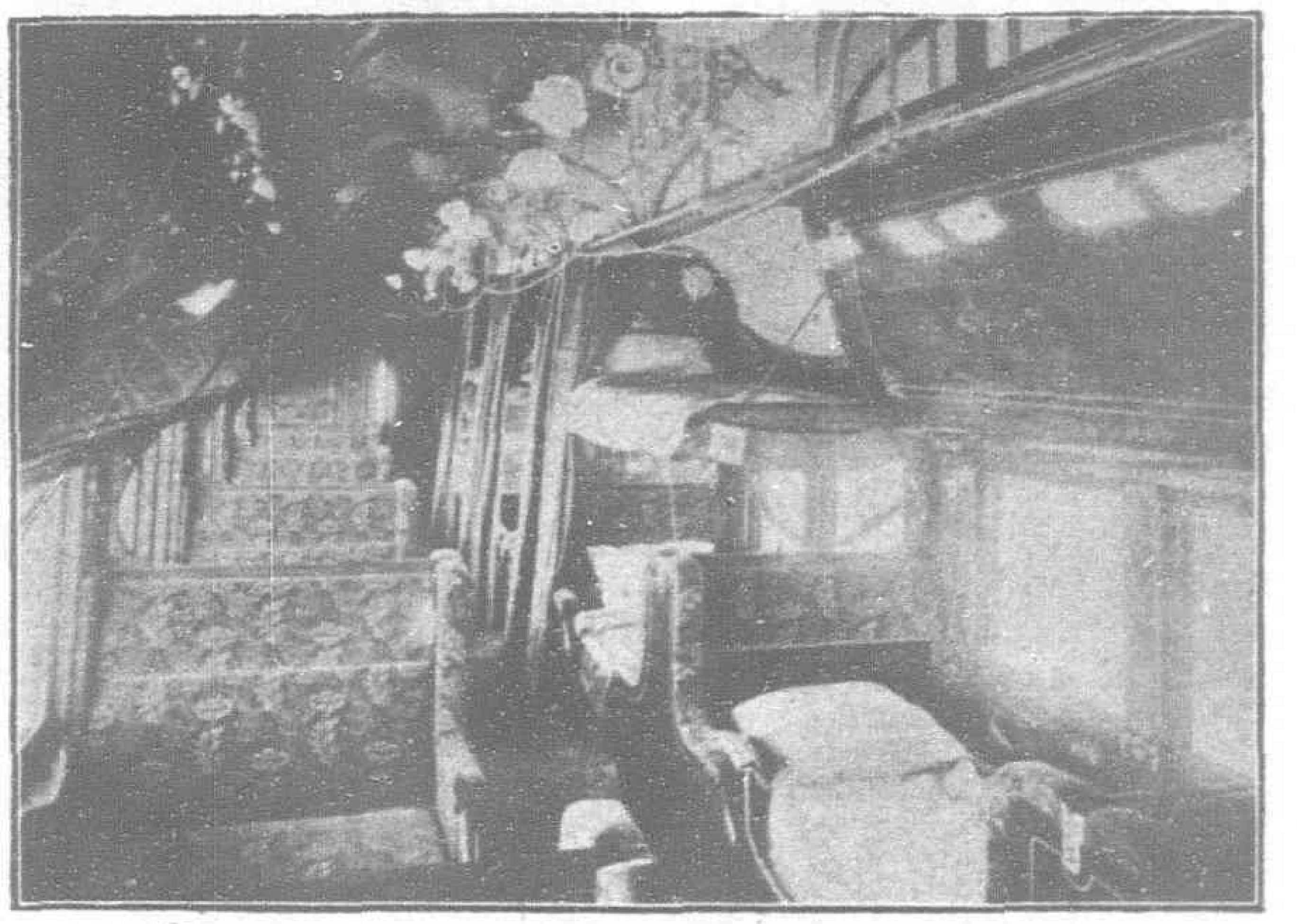
The authorized capital of the Company is two hundred million yen, which is divided into one million shares of 200 yen (about £20) each. The Japanese Government owns half of the total authorized capital, viz., 100 million yen, which is its share for the handing over to the Company of the complete railway lines in Manchuria with the properties attaching thereto (except the rolling stock and the rails and accessory materials on the Antung-Mukden line) and the coal mines of Fushun and Yentai—altogether of an assessed total value of 100 million yen.



S. M. R. EXPRESS
COMPLETE PULLMAN VESTIBULE TRAIN

The other half, viz., 100 million yen, was made available for subscription to and taken up by Japanese and Chinese subjects only; and the shareholders are guaranteed a dividend of 6 per cent. per annum by the Japanese Government. Owing to the economic conditions in Japan at the time of the establishment of the Company, however, the first issue of shares was limited to the amount of 20 million yen, of which only one-tenth was called up. Hence the shares not yet issued amount to 80 million yen, whilst the share capital subscribed but not yet paid up is 18 million yen.

PULLMAN DINING CAR
S. M. RY.



PULLMAN SLEEPING CAR
S. M. RY.

On April 1, 1907, the Company took possession of, and commenced operations on, the following properties, which constitute the investment of the Government:—

1.) The railway lines between Dairen and Changchun; Nankuanling and Port Arthur; Tashihchiao and Yingkou; Yentai on the main line and the Yentai coal mine; Suchiatun and Fushun; and Antung and Mukden.

2.) The machinery, implements, and other material actually in use on the above railways and mines, and also on the railway line between Mukden and Hsinmintun.

3.) The properties in land, buildings, and other establishments, both within and without the Kwantung Leased Territory, belonging to the above railways and mines.

The Mukden-Hsinmintun Railway, with all its appurtenances, was ceded to the Chinese Government by reason of an agreement entered into on April 15, 1907, its actual transfer taking place on June 1 of the same year; and in fulfilment of an agreement entered into in June, 1907, with the Russian Government at St. Petersburg, the railway lines and properties to the south of Kwanchengtzu Station, together with the coal mines of Shihpailing and Taochiatun and their appurtenances, were formally transferred to the South Manchuria Railway Company between July 15 and July 18, 1907.

With the object of raising, largely through debentures, the funds required for the reconstruction of these railways, as well as for the subsidiary undertakings described below, the Company has up to the present time issued in London three separate issues of debentures of a total amount of eight million pounds sterling at the uniform rate of interest of 5 per cent., both capital and interest being guaranteed by the Japanese Government. The following is a list of the debentures issued:—

1st Issue: 4 million pounds sterling, issued on July 19, 1907, redeemable within 25 years.

2nd Issue: 2 million pounds sterling, issued on June 1, 1908, redeemable within three years.

3rd Issue: 2 million pounds sterling, issued on December 16, 1908, redeemable on July 23, 1932.

The Industries and Enterprises of the Company. The Railways.—The Railways acquired from the Government on April 1, 1907, are as follows:—

The main line between Dairen and Changchun (437½ miles); the Port Arthur branch line (39 miles); the Liushutun branch line (3½ miles); the Yingkou branch line (13 miles); The Yentai branch line (9¾ miles); the Fushun branch line (39 miles); the Antung-Mukden line (189 miles).

The gauge of the whole of the above railways when acquired from the Government was 3 feet 6 inches, with the exception of that of the Antung-Mukden line, which was only 2 feet 6 inches. This, however, does not include the line from Mukden to Hsinmintun, which though originally included in the system, acquired by the Company, was ceded to China, as before mentioned.

Immediately after the acquisition of the above railways, the Company commenced, and without the slightest interruption of traffic, executed their reconstruction to the standard gauge of 4 feet 8½ inches—except the Antung-Mukden line—and also the doubling of the track between Dairen and Suchiatun, a distance of 238⅓ miles. So expeditiously was this performed that as early as November, 1907, traffic on the standard gauge was opened on the Port Arthur line, and on June 1, 1908, the entire main line, as well as the Fushun and Yingkou branch lines, had been rebuilt and completed. It was a source of great satisfaction to the Company to have been able to express its hearty approbation of the work done by its engineers on that occasion, for within the short time of one year, and in spite of many adverse circumstances and difficulties of every kind consequent upon the great war, they had succeeded in widening the gauge on more than 500 miles of railway line, at the same time erecting more than 200 locomotives and 2,500 cars newly received, thus making it possible for the Company to effect the change to standard gauge practically without interruption of traffic for a single day and without the slightest obstruction.

In order to improve the through traffic between Europe and the Far East, the Company inaugurated in October, 1908, an express service between Dairen and Changchun, consisting of Pullman sleeping and dining cars of the latest type. The express trains run three times a week, and connect at Changchun with the Siberian trains of the International Sleeping Car & Express Train Co. and Russian State Express, and at Dairen with the steamship service operated by the Company between Dairen and Shanghai twice a week. In accordance with the terms of a provisional convention concluded by the Russian and Japanese Governments on June 13, 1907, respecting the through traffic on the Russian and Japanese Railways in Manchuria, this Company entered into an agreement with the Chinese Eastern Railway Company respecting the passenger and baggage through traffic, which was approved by the Japanese Government on December 1, 1909.

An agreement has also been made with the Imperial Japanese Government Railways, the Osaka Shosen Kaisha (Osaka Mercantile S. S. Co.), and the Nippon Yusen Kaisha (Japan Mail S. S. Co.) regarding through transportation of cargo. This was put into effect from the 1st of January, 1911, simultaneously with through goods traffic between Shanghai and the principal stations on this Railway.

By virtue of these arrangements, immense facilities are now obtainable in through cargo transportation at this Company's principal stations with many ports in the East, as well as in Europe, Australia, and the United States of America, regularly touched by the Nippon Yusen Kaisha and Osaka Shosen Kaisha steamers.

The doubling of the railway track on the section between Dairen and Suchiatun also progressed rapidly, and the double line was opened for traffic in its entire length on October 27, 1909.

MOUNTAINS OF BEANS AWAITING SHIPMENT AT DAIREN

The reconstruction of the Antung-Mukden narrow-gauge line to standard gauge was commenced in August, 1909, and proceeded so rapidly that the Mukden-Shihchiaotsu section (35 miles) was opened for traffic on November 3 of the same year; the Antung-Chikuanshan section on November 3, 1910; and the Shihchiaotsu-Penhsihu section by the end of December, 1910. With regard to the remaining section, from Penhsihu to Chikuanshan (73 miles), notwithstanding considerable engineering difficulties that are almost constantly being met with, so remarkable a progress is being made that it is expected the work will be completed by March, 1912.

The Yingkou branch line, which formerly had its terminus at Niuchiatun, has been extended as far as the new Japanese town of Yingkou, where a new station was built and opened for passenger traffic in November, 1909, and the old station is being utilized as a goods office.

The reconstruction of the Yentai branch line, which became necessary in consequence of the increased output of the Yentai coal mine, was also completed; and on March 1, 1910, goods trains commenced to run between Liaoyang and the Yentai coal mine.

The Linshutun branch line, though at present not in operation, has also been reconstructed to standard gauge in accordance with an order from the Home Government.

The reconstruction of all the railways enabled the Company to dispense with the rolling stock of narrow gauge, which was therefore sent back to Japan in 1908. This comprised 217 locomotives, 3,727 goods cars, and 157 passenger cars.

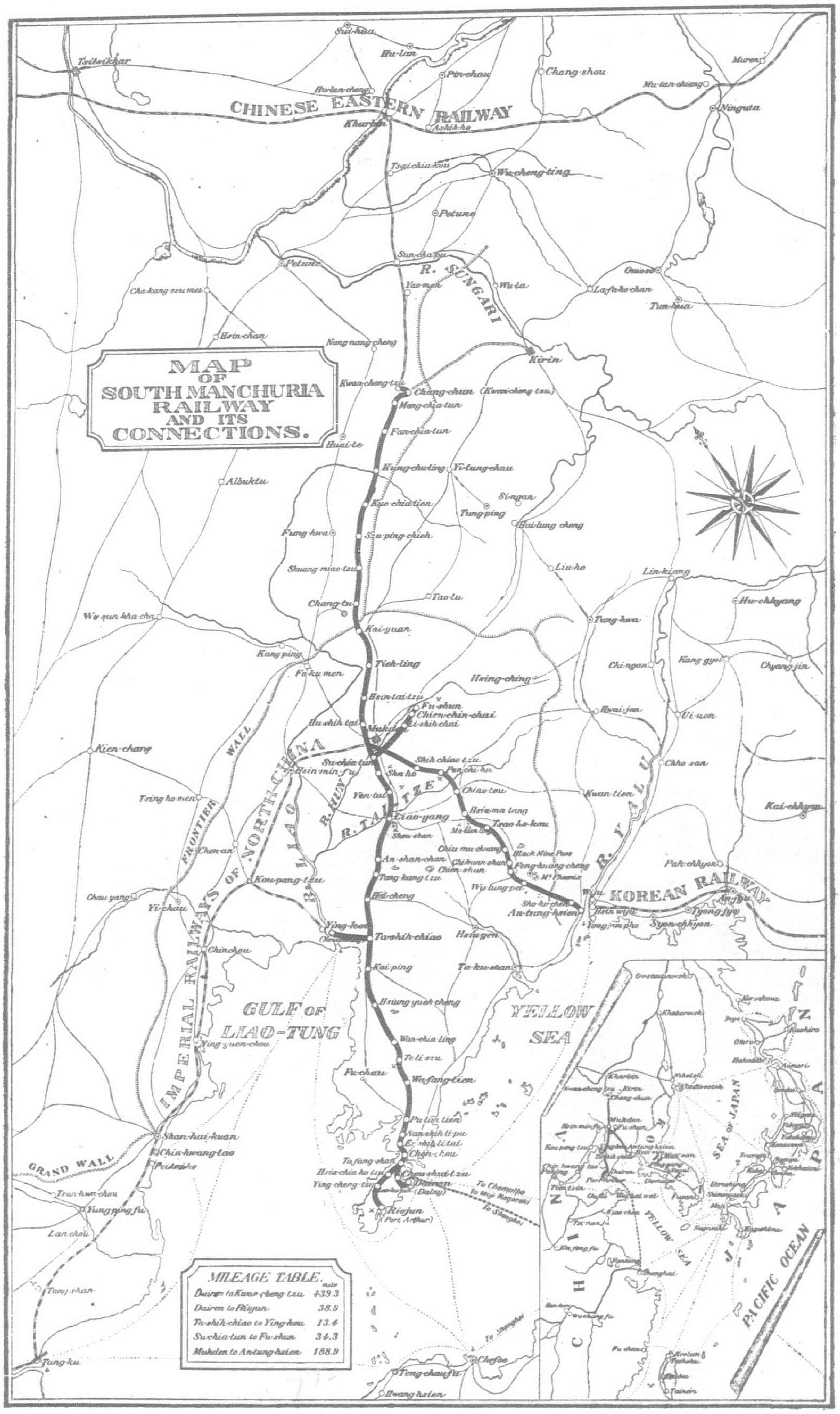
The rolling stock in use at the end of the first half of the working year 1910 was as follows:—

On the main and branch lines of standard gauge: 216 locomotives, 2,315 goods cars (2,190 thirty-ton cars and 125 fifty-ton coal cars), and 125 passenger cars.

On the Antung-Mukden light rail line: 82 locomotives, 650 goods cars, and 54 passenger cars.

Originally, a central railway workshop had been erected in Dairen for the construction of rolling stock, repairs, and other works, not only to meet the requirements of the company but also those from outside. Besides this central workshop, small workshops for the repair of rolling stock, machinery, and implements were established in Liaoyang, Kungchuling, and Antung. However, as these workshops soon proved to be altogether too small and insufficiently equipped to cope with the ever-increasing demand, it was decided to erect a new and in every respect modernly equipped workshop on an extensive scale at Shahokou near Dairen; and this is now fast nearing completion. When completed, this workshop will be able to execute repairs at once on 20 locomotives and 46 goods cars of 30 tons each, and at the same time construct and repair other railway materials, mining machinery, etc. The Company also intends to gradually enlarge and improve the other workshops.

The passenger and goods traffic has been steadily increasing since the commencement of the Company's business, as will be seen from the following business returns for half-years. (In this connection, however, it must be observed that beans and bean cakes form by far the greater portion of the goods traffic, and since the transportation of this produce from the interior to the railway and from the railway to the ports must of necessity be mainly done during the winter season it naturally follows that the revenue during the second half of each working year must be greater than that of the first half. In order, therefore, to arrive at a proper conclusion with regard to the financial progress achieved so far, it is necessary to compare winter and summer half-years between themselves).



Working year.	Term.	Passengers.	Tonnage of goods. (American Tons)	Receipts in yen.	Expenditure in yen
1907	1st Half	704,300	533,283	4,093,425	2,757,446
	2nd Half	807,981	953,151	5,675,462	3,344,168
1908	1st Half	910,946	1,083,064	4,372,751	2,517,589
	2nd Half	937,194	1,625,972	8,164,391	2,573,818
1909	1st Half	1,029,418	1,756,225	5,858,158	2,609,968
	2nd Half	1,149,644	1,512,302	9,158,040	3,208,365
1910	1st Half	1.324,952	1,670,271	5,594,767	3,015,832

Shipping.—The increasing through traffic from Europe to the Far East, as a result of the reconstruction of the railways, induced the Company to institute a regular steamship service between Dairen and Shanghai by chartering the steamer "Kobe Maru" from the Nippon Yusen Kaisha; and this service was opened on August 10, 1908.

This steamship line connects the shortest and quickest route from Europe to Shanghai, and as an annex to the South Manchuria Railway line is equally important for passenger and goods traffic as well as for mails. As the advantages of this route have become to be generally recognised, this steamship service has gradually expanded, so that it became necessary to charter another steamer from the same steamship company; and the "Saikio Maru" chartered in May, 1909, now runs alternately with the "Kobe Maru" on this twice-weekly service.

The following figures give the results of the passenger and goods traffic during the last five half-years:—

Working year.	Term.	Passengers.	Freight tonnage (American Tons)	Receipts in yen.	Expenditure in yen.
1908	1st Half	190	495	5,831	39,553
	2nd Half	1,536	10,264	66,750	164,646
1909	1st Half	1,985	13,735	90,163	230,722
	2nd Half	2,340	17,821	101,075	215,574
1910	1st Half	2,368	20,170	1.7,377	225,418

The Harbour.—As regards the construction of Dairen Harbour, it is intended mainly to follow the plan originated by the Russians, and to complete the works left unfinished. The principal construction works taken over and executed so far by the Company are as follows:—

(1). The construction of the East Breakwater, which stretches out from the northern end of the East Quay towards the northeast, and is 1,221 feet long, 20 feet wide at the top, and 19 feet above water at low tide. Between the East and the North Breakwaters a sea passage 1,200 feet wide is left open. About 70 per cent. of all the construction works have been completed up to date (January, 1911).

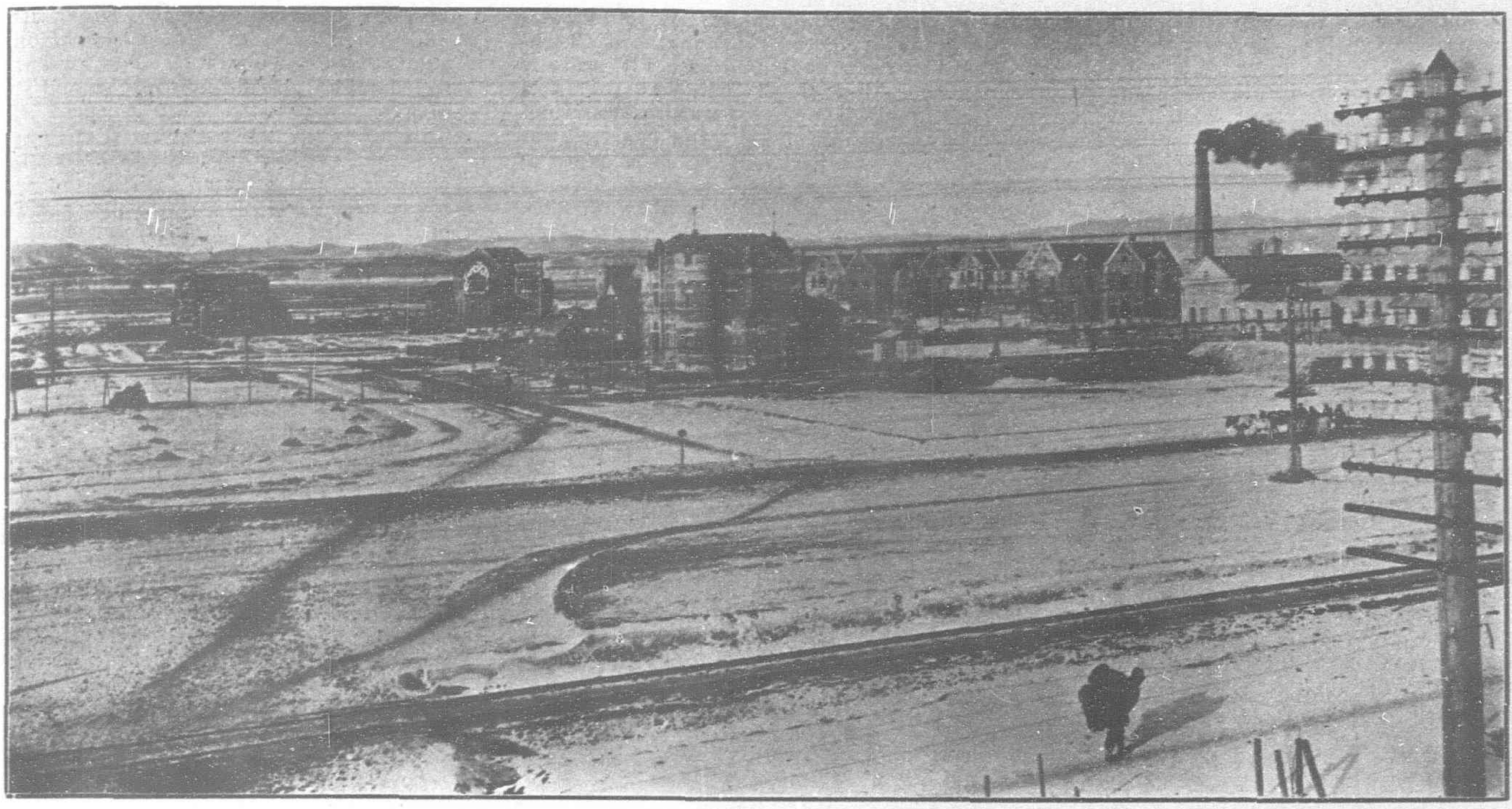
(2). The wall of the East Quay. The southern part of the quay had been completed and the construction of the northern part commenced by the Russians. It was decided to take down the uncompleted part, and construct in its stead another wall extending from north to south and from east to west. This quay wall is 909 feet long, 540 feet wide, and 30 feet above low water. More than 57 per cent of this work has been completed.

(3). The Northwest Breakwater. Stretching from a point about 1,200 feet distant from the end of the East Breakwater towards northwest, this breakwater is to be 12,500 feet long, from 10 to 20 feet wide at its crest, and from 17 to 19 feet above low water. So far, 16 per cent. of this work has been completed.

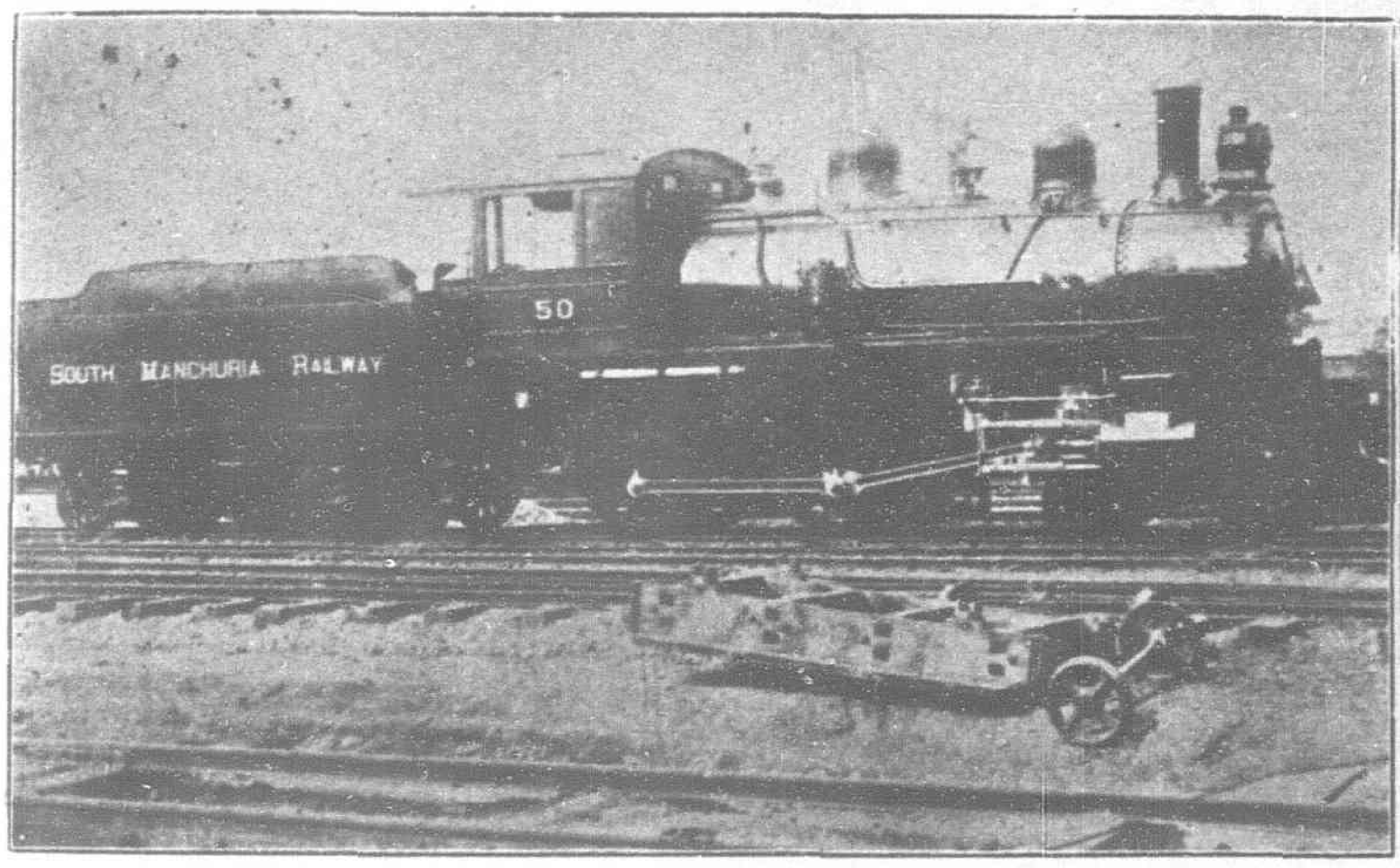
(4). The dredging of the port. The total quantity of mud to be dredged is estimated at 15 million tons, of which at present only 20 per cent has been removed. But the steam dredger, "Heito Maru,"of 573 tons, constructed on the latest plan by Messrs. Ferguson Bros., of Glasgow, at a cost of about £30,000, is now on her way from Europe to Dairen, where she is expected to arrive in April next. The work of dredging the port will then be taken in hand with much greater celerity and thoroughness.

Reclamation work on the east coast of the city of Dairen is also shortly to be commenced; and besides the repair and construction work on the east quay-wall, the construction of an embankment at the Public Wharf (Junk Wharf) on the northern coast of the city is being steadily pushed forward.

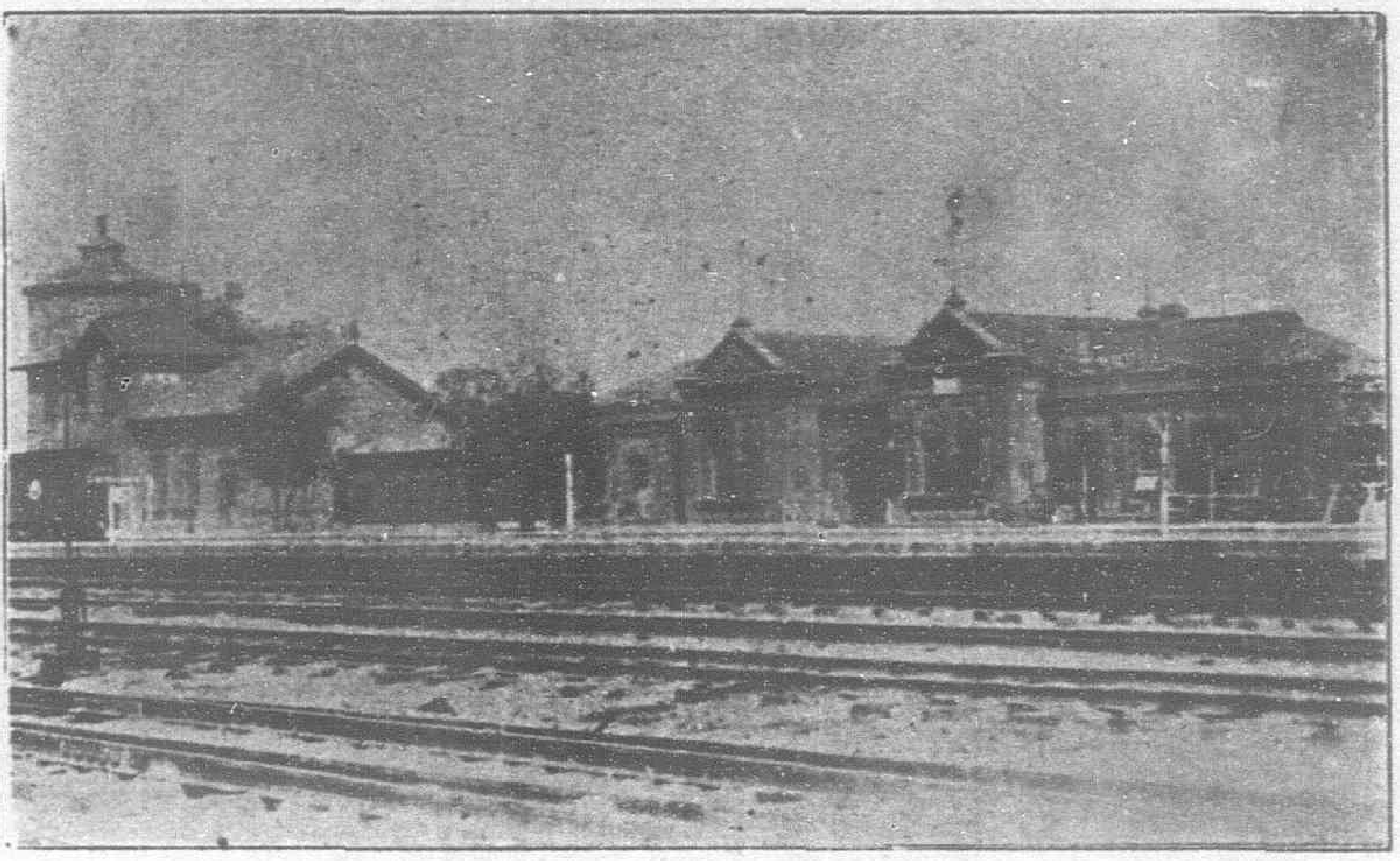
The facilities of the harbour have been improved by the introduction of steam launches, warehouses, sheds and several other accommodations calculated to further the convenience of the passenger and goods traffic. The loading and discharging of goods at the port, which had hitherto been entrusted to numerous forwarding agents, was in October, 1907, brought under the direct management of the Company; and this step has been entirely justified by the subsequent improvement in the method and work of transportation. The amount of goods entering and leaving the port of Dairen increases



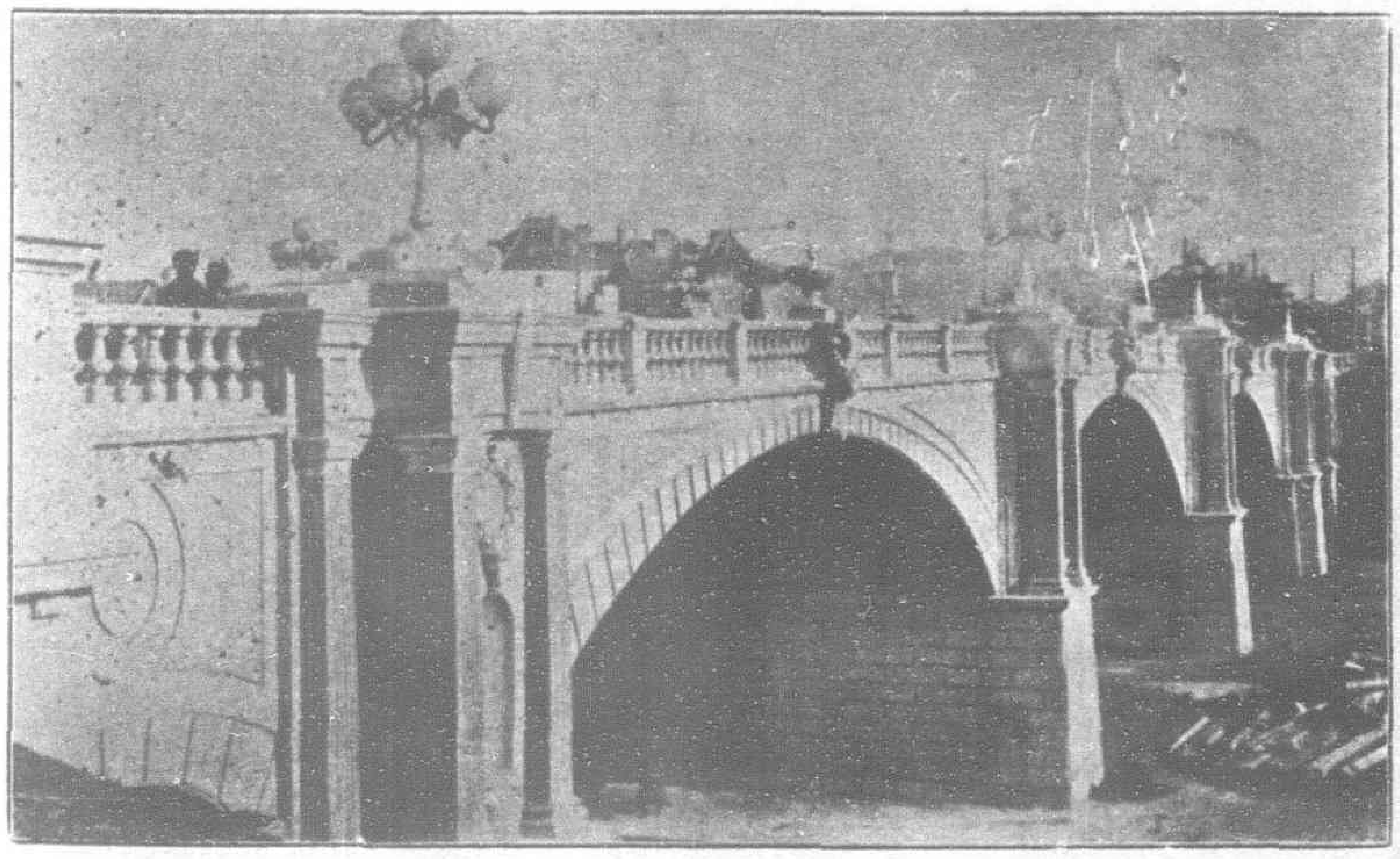
FUSHUN COAL MINES, SOUTH MANCHURIA RAILWAY



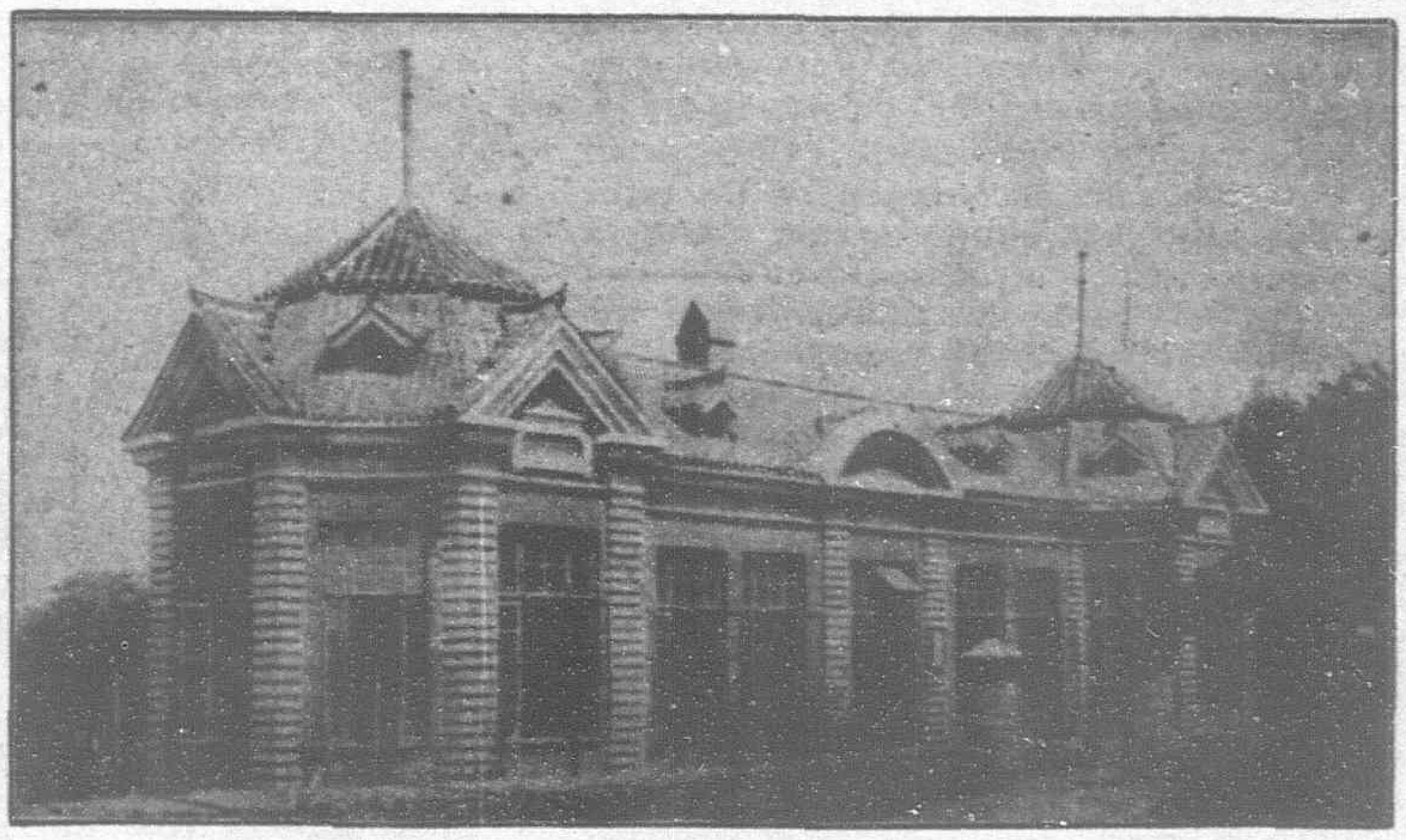
SOUTH MANCHURIA RAILWAY—AMERICAN LOCOMOTIVE



LIOYANG STATION



NIPPON BRIDGE, DAIREN



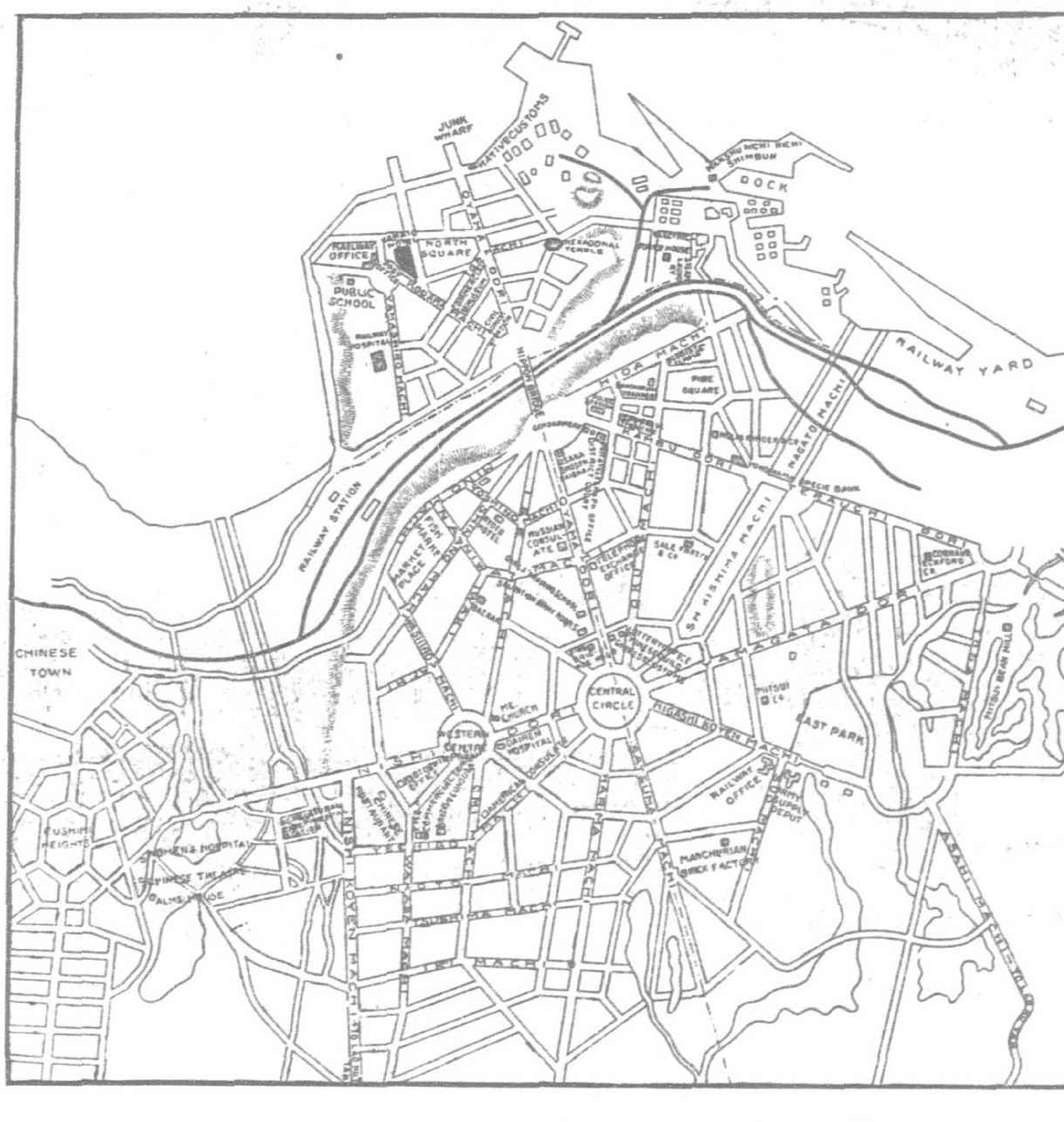
JAPANESE LABORATORY AT DAIREN

year by year, and during the winter season especially the pressure in the port is enormous, making it utterly impossible for manual labour (the only labour up till now used in the p rt) to satisfactorily cope with the traffic. With a view to obviate this difficulty, the introduction of grain-elevators is now under consideration. Moreover, attention is also being paid to the introduction of especial loading devices for coal cargoes.

The following are the financial results of the harbour administration since coming under the direct management of the Company:—

Working year.	Term.	Number of ships arrived at wharf.	Tonnage of goods loaded and discharged. (American Tons).	Receipts in yen.	Expenditure in yen.
1907	2nd Half	633	417,315	425,644	496,526
1908	1st Half	659	340,737	319,795	328,206
	2nd Half	738	729,393	701,033	518,470
1909	1st Half	673	610,171	637,166	533,590
	2nd Half	703	756,428	743,565	599,702
1910	1st Half	772	604,161	474,080	417,796

On April 1, 1910, the Company was granted a concession by the Government authorizing it to make use of the port of Port Arthur to erect there a pier for the loading of coal, and to dredge part of the port. The completion of these works will constitute an important step towards the expansion of the coal export trade.



MAP OF DAIREN (DALNY)

Coal Mines.—The Fushun Colliery is situated about 22 miles east of Mukden as the crow flies. The coal field, running for about 12 miles parallel with the river Hun, shows an average gradient of about 30 degrees in the direction of the river. The coal deposits are from 80 to 175 feet in thickness, an average of about 130 feet, and contain at least 800 million tons. At the time of the acquisition of the colliery by the Company, the mining arrangements were of a temporary nature, with a daily output of 360 tons, which was all expended to meet the military requirements only. In consequence, however, of the extensive introduction of machinery and other improvements, the total daily output of the seven pits now in operation has been increased to 3,000 tons.

Work has also been taken in hand to sink a pair of shafts about 1,100 feet deep in Chienchinchai and Yangpaipu, of which one is to have an open diameter of 18 feet and the other of 21 feet. The shaft in Chienchinchai has been named Oyama Pit, and the one in Yangpaipu Togo Pit. At the first pit, on which the work of sinking was commenced in November, 1907, the coal bed was reached on December 1, 1909, at a depth of 1,160 feet, whilst at the latter pit sinking operations were started on November 19, 1908, and the coal seam was reached at a depth of 1,102 feet. When Oyama and Togo Pits are completed the daily output is expected to reach 2,500 tons per day from each pit.

The following figures show the total output mined during the several business periods:—

Working year.	Term.	Tons (English)
1907	1st Half	94 893
	2nd Half	138,432
1908	1st Half	204,529
	2nd Half	386,191
1909	1st Half	335,467
	2nd Half	370,575
1910	1st Half	415,047

Besides mining operations at Fushun, the building of the new Japanese town of Chienchinchai, electricity, gas, and water works, school and hospital, etc., call for special notice. The construction of the new town is making satisfactory headway. The electricity works commenced the supply for lighting and industrial power in December 1908, and the consumption reached 957,451 kilowatts in the first half of year 1910. The distribution of gas and water has also been commenced, and nearly five million cubic feet of gas have already been supplied. The school has now an attendance of 1,380 children, whilst the hospital during the first half-year of 1910 gave treatment to 8,975 cases. It has also been decided to establish a technical school in Fushun, which is to be opened in April, 1911.

The demand for coal in Manchuria shows an increasing tendency. As a result of the efforts made by the Company to promote the introduction and adoption of the use of coal in bean mills and other factories, the total sale of coal during the first half of the working year 1910 amounted to 111,123 tons, whilst the total exported to Shanghai, Canton, Hongkong, Singapore, Tientsin, Hankow, Chefoo, Harbin, Korea (Chosen), and other parts of the world amounted to 182,601 tons. A first trial shipment of coal to Shanghai, made in the second half-year of 1907, met with such success that the Company has since extended the experiment to other places. Since April 27, 1910, the steamer "Buyo Maru" (1,813 net registered tons) has been chartered for the transport of coal chiefly to Hongkong, and another steamer, the "Omuro Maru" (1779 net registered tons) for the transport chiefly to Canton.

The following figures show the various quantities sold, and the business results of the mining operations:—

Working year.	Term.	Sale of coal in tons.	Mining	
			Receipts in yen.	Outlay in yen
1907	1st Half....	76,949	647,066	548,251
	2nd Half....	125,871	837,154	582,963
1908	1st Half....	211,808	1,322,503	816 144
	2nd Half....	231,705	1,380,119	859,189
1909	1st Half ...	344,457	1,983,227	1,355,672
	2nd Half....	369,598	2,042,538	1,440,098
1910	1st Half....	419,248	2,217,807	1,593,570

Electricity.—The Russians had made but a small and crude beginning towards furnishing the city of Dairen with the uses and advantages of electricity. When taken over by the company from the Japanese Government, the plant was merely an imperfect means of telegraphic and telephonic communication; but thanks to the zealous efforts made by the company's management a supply of power for lighting and industrial purposes was commenced as early as October, 1907; and as the demand soon exceeded the supply, it was decided to increase the power to 3,000 kilowatts. The work of extension was put in hand in the second half of 1908, and two motor engines with accessory plants of a productive power of 1,000 kilowatts were shortly afterwards put in operation.

The company also resolved upon the construction of electric tramways through the streets of Dairen to an aggregate length of 13 miles, the larger portion of which has been completed and is in use. The tram fares are uniform for the city lines, and are priced on the time limit basis. The cars are divided into first-class and second-class compartments, and the fares are 5 sen (1¼d.) for half-an-hour and 6 sen (1½d.) for an hour for first-class passengers, and a sen (or farthing) cheaper for second-class passengers. The tickets are punched at the time limit by reference to a clock in the car, and are available for any number of rides on any line within the half-hour or hour as the case may be. The erection by the Company of large railway workshops at Shahokou and of a sea-side hotel at Hoshigaura (Star Beach), one of the finest seaside resorts in North China, rendered it necessary to lay a suburban line, which connects with the city lines. The running on the suburban line was commenced on January 1, 1911, the single fare for the whole route being 2½ d. and 2 d. for first and second classes respectively.

Furthermore, as an accessory to the electrical enterprises, an electric park was laid out and opened for public amusement on September 25, 1909. Though the park management was at first undertaken by a private resident, it is now controlled by the Company itself.

The following table shows the growth of the electricity undertakings in Dairen, Mukden, and Changchun:—

Working year.	Term.	Dairen: Aggregate quantity produced in kilowatts.	Dairen: Receipts in yen.	Dairen: Outlay in yen.	Mukden: Aggregate quantity produced in kilowatts.	Mukden: Receipts in yen.	Mukden: Outlay in yen.	Changchun: Aggregate quantity produced in kilowatts.	Changchun: Receipts in yen.	Changchun: Outlay in yen.
1907	1st Half......	297,965	5,674	39,307	—	—	—	—	—	—
	2nd Half......	627,549	59,247	61,930	—	—	—	—	—	—
1908	1st Half......	735,581	90,905	73,186	61,678	5,825	8,149	—	—	—
	2nd Half......	1,060,833	114,553	106,584	150,258	14,119	16,187	—	—	—
1909	1st Half......	1,105,229	140,124	124,358	131,506	16,175	15,812	—	—	—
	2nd Half......	2,204,639	197,058	213,292	186,045	15,081	15,850	58,305	2,715	5,845
1910	1st Half......	2,541,125	283,656	207,[illegible]21	157,859	14,964	15,752	220,341	21,542	18,679

Gas.—In order to meet the demand for gas for lighting, heating, and industrial purposes, the Company decided to establish gas works in Dairen with a productive power of 280,000 cubic feet. The installation, including all building construction and laying of pipes, has almost entirely been completed, and gas has been supplied since March, 1910, the total amount produced during the first half of that year being 7,176,400 cubic feet. The coal consumed in the production of the same was 625 English tons. In addition, 434 tons of coke, 8,786 gallons of tar, and 2,251 lbs. of sulphate of ammonia were produced as subsidiaries, thus averaging 10,483 cubic feet of gas, 14 cwt. of coke, and 14 gallons of tar per ton of coal.

MR. Z. NAKAMURA, PRESIDENT OF THE SOUTH MANCHURIA RAILWAY COMPANY.

Hotels.—The Yamato Hotel in Dairen was opened by the Company on August 1, 1908, after having been in course of preparation since the preceding April. But as a result of the largely increased tourist traffic, consequent upon the opening of the Company's steamer service between Dairen and Shanghai and the growing popularity of the Trans-Siberian route as the quickest journey between the Far East and Europe, the original hotel establishment was quickly found to be unable to meet the requirements. In order to obviate this difficulty, it was decided to begin at once with the construction of a new establishment on a large scale. The new hotel, in process of erection with other palatial public buildings around the Central Circle of the city, will, it is said, be one of the finest hotels in the Far East.

On March 21, 1908, the Yamato Hotel in Port Arthur was opened.

In 1907 the construction of a new hotel in Changchun was taken in hand, and at the same time the club-house belonging to the Company was converted into a temporary hotel to make up for the deficiency for the time being. This provisional hotel was thrown open on October 1, 1908. The new hotel was opened on February 1, 1910, on which day it give hospitality to the Imperial Chinese Prince Tsai Hsun (just returning from a tour in Europe) as its first guest.

The new hotel in Mukden, which forms part of the railway station, was opened on October 1, 1910.

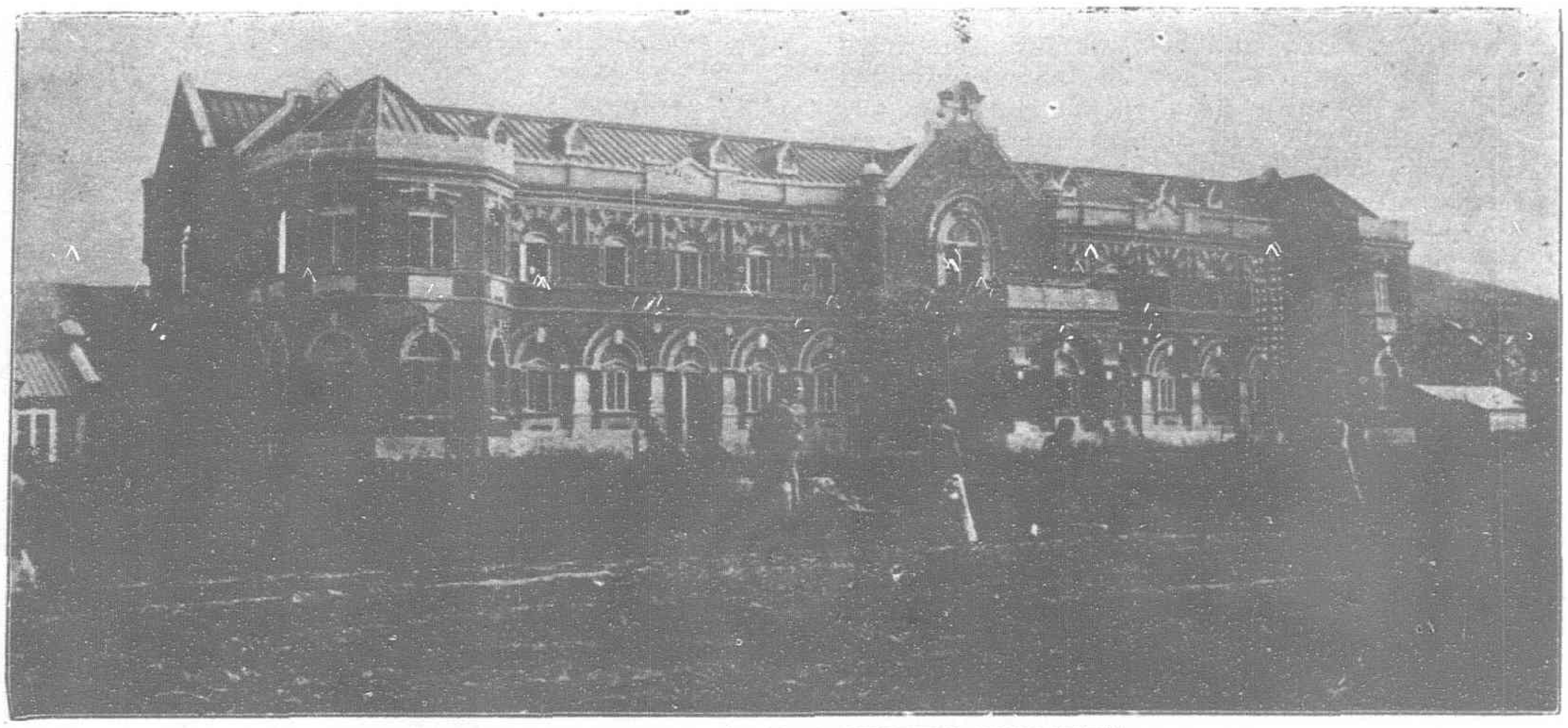
The following figures represent the number of daily guests accommodated by the various Yamato Hotels (visitors who stayed more than one day being counted for as many days as they stayed):—

Working year.	Term.	Dairen.	Port Arthur.	Changchun.
1907	1st Half	338	—	—
	2nd Half	1,136	40	—
1908	1st Half	1,542	791	—
	2nd Half	2,014	505	1,144
1909	1st Half	3,337	886	877
	2nd Half	3,321	497	1,589
1910	1st Half	3,573	702	1,767

With a view to providing seaside resorts for residents and visitors during summer, it was decided by the Company to establish a pleasantly situated and well equippel hotel, on a point of the sea shore about 5 miles to the south-west of Dairen called Hoshigaura (Star Beach), noted for its charming scenery and invigorating climate. In addition, there has been built a number of bungalows and villas, in both Japanese and European styles, which are let furnished at moderate rent. These accommodations were opened for use on August 8, 1910; and bathing, boating and sporting facilities have also been generally introduced.

This favourite resort can be reached in about 45 minutes by a direct tram car service operated from Dairen at intervals of about half an hour. Other arrangements to make the place attractive are now in rapid progress.

The Management of the Railway Area.—By virtue of the powers delegated to the Company by the Japanese Government to collect rates and fees from the residents in the railway area, as contributions toward the cost of management of the district, the



GENERAL OFFICE OF THE FUSHUN COLLIERY

FUSHUN POLICE STATION

Company has published an agreement concerning residence in the Railway Area and regulations concerning the rates and fees. According to these regulations, the outlay for buildings and improvements of public utility within the railway area is borne by the Company, whilst the current expenses in connection therewith are paid out of the rates and fees from the residents, the Company making good any deficit.

The following figures show the amounts the Company has defrayed for the management of the Railway Area:—

Working year.	Term.	Deficit in yen.
1907	2nd Half	885
1908	1st Half	18,577
	2nd Half	21,982
1909	1st Half	36,818
	2nd Half	47,453
1910	1st Half	74,247

The Company's land management comprises the following branches:—

1.—Building and Management of Railway Towns.—The population and housing in the railway area is steadily on the increase. At the end of 1907 there were 8,647 houses and 29,524 residents, while at the end of 1910 there were 14,162 houses and 57,632 residents. Plans of building on up-to-date lines of town-planning have been prepared for the following fifteen places, viz., Wafangtien, Hsiungyuehcheng, Kaiping, Tashihchiao, Haicheng, Liaoyang, Mukden, Tiehling, Kaiyuan, Changtu, Shuangmiaotzu, Szupingchieh, Kungchuling, Fanchiatun and Changchun. In the following places the works taken in hand for the construction of roads and drains have already been completed to allow of their utilization in part, viz., Wafangtien, Tashihchiao, Liaoyang, Mukden, Tiehling, Kaiyuan, Szupingchieh, Kungchuling, and Changchun. Waterworks have been constructed at Wafangtien, Liaoyang, Tiehling, and Kungchuling on a scale sufficient to meet the present requirements. Plans for the construction of waterworks on a larger scale in Mukden and Changchun are still in course of preparation. Parks have been created in Dairen, Wafangtien, Tashihchiao, and Changchun; and agricultural experimental stations established in Dairen, where plants, flowers, and vegetables of various kinds are cultivated. Markets have been established in Liaoyang, Kungchuling, and Changchun; and in Kungchuling there is a slaughter-house under the management of the Company. Cemeteries and crematoriums have been established in Wafangtien, Hsiungyuehcheng, Tashihchiao, Liaoyang, Mukden, Tiehling, Kungchuling, and Changchun. The sanitary and fire-extinguishing arrangements also form part of this department.

2.—The Lease of the Land and Buildings within the Railway Area.—The total area of the land belonging to the Railway amounts to 55,638,000 tsubo (or about 46,000 acres), and all this land, together with the house property erected thereon, is offered by the Company on lease, with the exception of that occupied by the military and civil departments of the Kwantung Government. The rent per tsubo for building land is from 5 rin to 10 sen per month, while the rent per tsubo for agricultural purposes is from 1 rin to 3 sen per month (or at the rate of from £1 10s. 0d. to £45 per acre per annum). The amount of rent is fixed according to the situation and surroundings.

The following is the proportion of the Railway Area already rented:—

Working year.	Term.	Area.	Rent.
1907	1st Half...	7.420,000 tsubo (including 51,000 tsubo of building land).	24,205 yen
1910	1st Half...	15,317.490 tsubo (including 414,986 tsubo of building land).	66,000 yen

The buildings rented were as follows:—

Working year.	Term.	Number.	Rent.
1907	1st Half...........	391 (embracing 8,790 tsubo of building land).	6,185 yen
1910	1st Half...........	445 (embracing 9,776 tsubo of building land).	11,720 yen

The above figures show the steady development of the Railway Area.

NOTE—1 tsubo is about 36 square feet, 1,224 "tsubo" is qual to 1 acre; 10 rin make 1 sen; and 2 sen are equivalent to 1 cent in American money and 1 half-penny in English money.

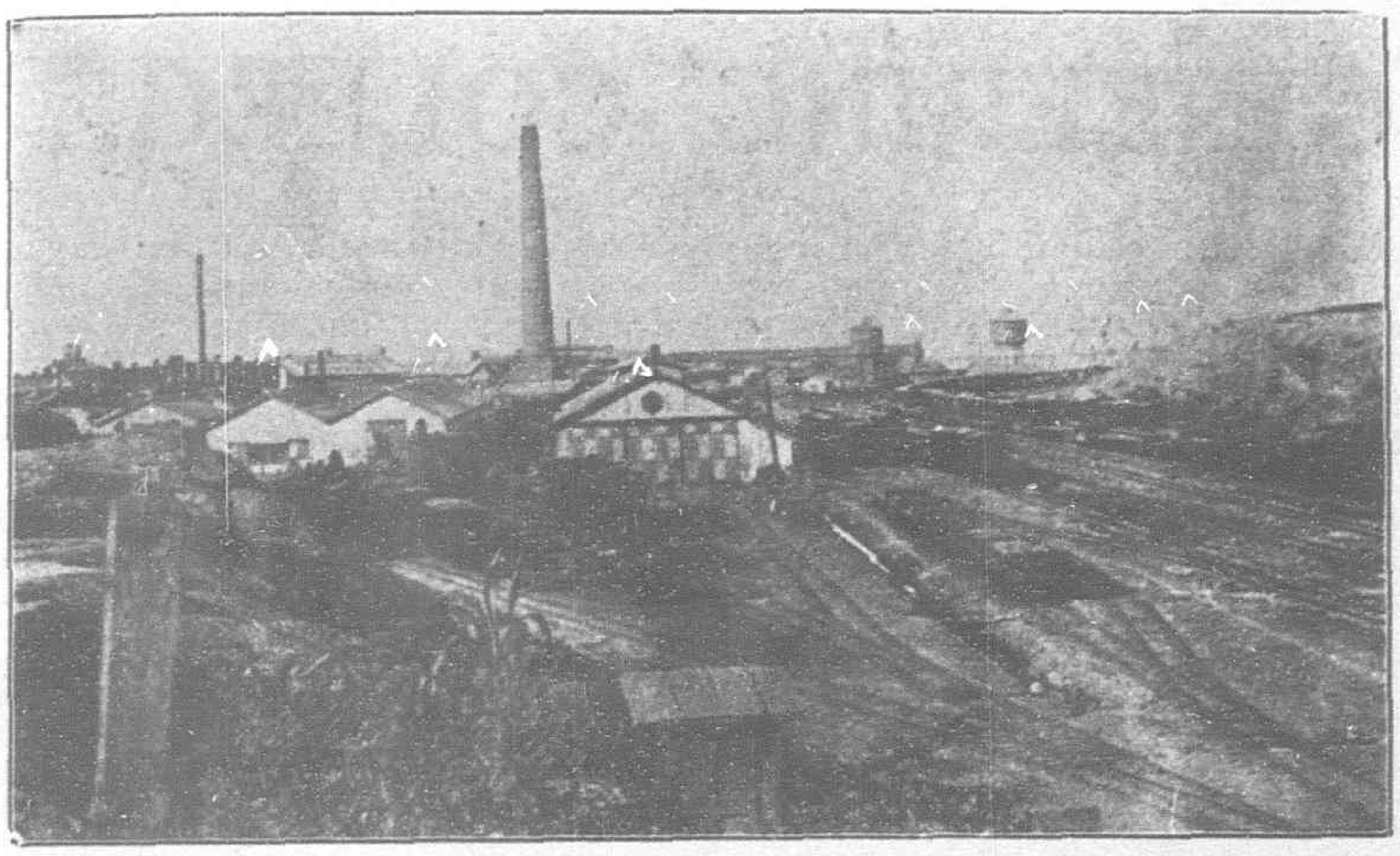
3.—Hospitals.—Before coming under the management of the Company there existed in Dairen a central military hospital, as well as branch hospitals or stations in Wafangtien, Tashihchiao, Liaoyang, Mukden, Tiehling, Kungchuling, Chienchinchai, Tsaohokou, and Antung, all of which were for military purposes. After the acquisition of the hospitals, the Company made special efforts to expedite the completion of the Hospital Department, with the result that there are now central hospitals in Dairen and Chienchinchai (Fushun), with branch hospitals in Wafangtien, Tashihchiao, Liaoyang, Mukden, Tiehling, Kungchuling, and Changchun, and branch stations in Changtu, Chiaotou, Penchihu, Tsaohokou, Chikuanshan, and Antung, and medical stations in Hsiungyuehcheng, Kaiyuan, Szupingchieh, Haicheng, Shihchiaotzu, and Yentai. The treatment in these institutions is not confined to the officer and employees of the Company, but is extended alike to all the residents. Above all, the hospital in Dairen has been made a central institute, comprising the following 9 departments, viz., Interclinique, Surgery, Rhino-laryngo-otology, Dentistry, Dermatology, Ginecology and Tocology, Ophthalmology, Kinderclinique and Bacteriology. The hospital has beds for about 150 patients which are almost always occupied, besides a daily consultation attendance of about 700 persons.

The number of patients and the financial results of the working of the hospitals during the several half-years may be seen from the following table:—

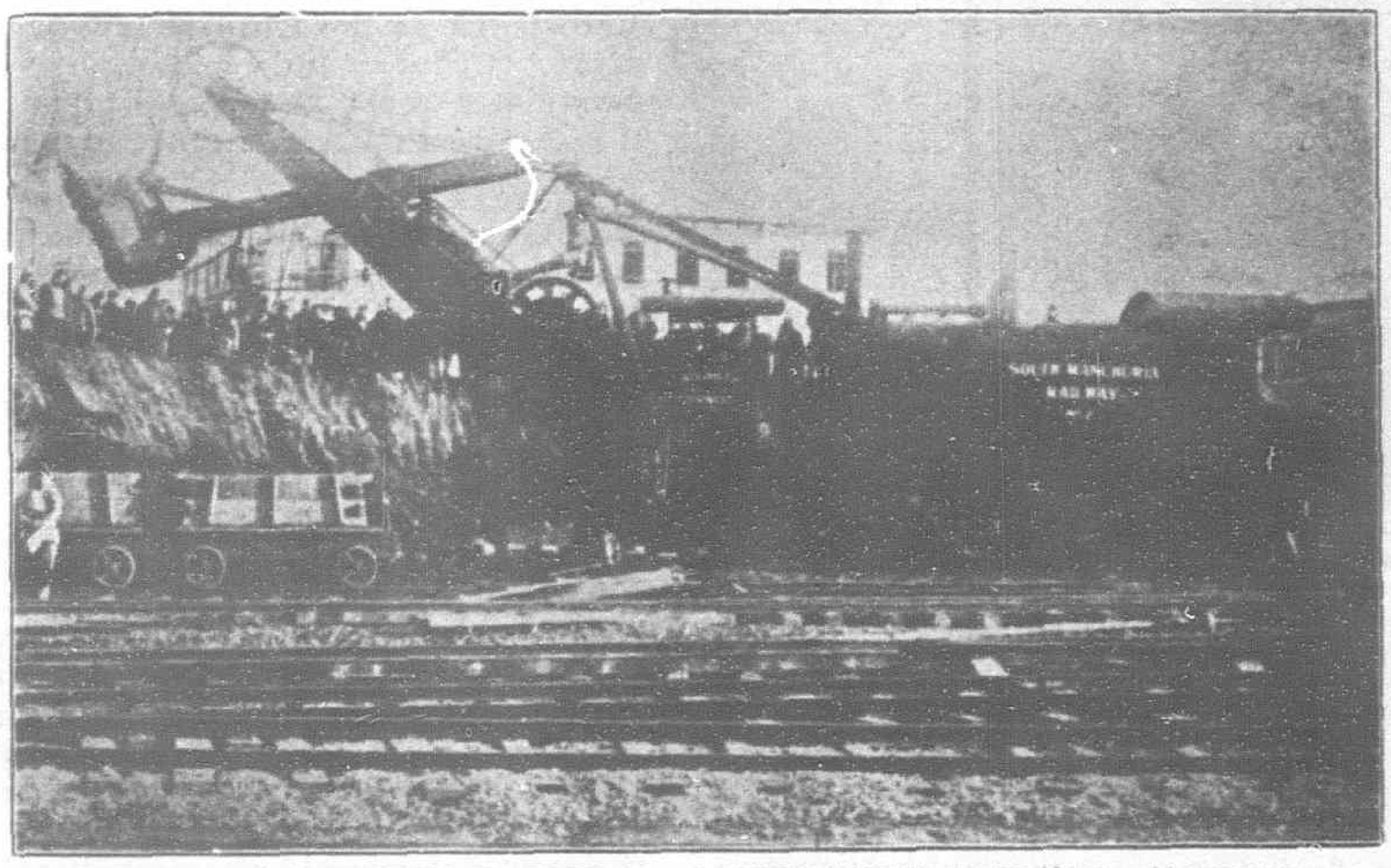
Working year.	Term.	In-door patients.	Out-door Patients.	Receipts in yen.	Outlay in yen.
1907	1st Half	10,526	117,852	2,880	66,469
	2nd Half	20,878	112,985	38,472	119,003
1908	1st Half	42,561	200,822	73,227	126,899
	2nd Half	44,785	167,795	72,291	123 850
1909	1st Half	58,428	253,456	94,690	145,154
	2nd Half	59,878	213,560	89,577	183,072
1910	1st Half	79,680	352,351	123,992	233,047

NOTE.—The above table does not include the figures of the Fushun Colliery Hospital.

4.—Education.—The Company has established primary schools at Wafangtien, Tashihchiao, Liaoyang, Mukden, Changtu, Kungchuling, Changchun, and Fushun, and branch schools at Szupingchieh, Haicheng, Chiaotou, Chikuanshan, Hsiungyuehcheng, Penchihu, and Tsaohokou. There are no schools established by the Company up to the present time at Tiehling, Antung, and Yingkou, but the children in these places are, by special arrangement, attending Japanese schools outside the railway area. In July, 1909, a public school for Chinese children was established at Kaiping, and special classes for the education of Chinese children have recently been attached to the schools at Liaoyang and Hsiungyuehcheng. At most of the above schools continuation classes for technical and industrial education has been instituted. Dormitories



EMPLOYEES' QUARTERS, DAIREN



SOUTH MANCHURIA RAILWAY—AMERICAN EXCAVATOR AT WORK

have also been added at many of these places. Libraries, playgrounds, and other facilities that are calculated to promote general education have been introduced at several places along the railway line.

The following figures show the increase of school children in the railway area:—

Period.	Number attending School.
At the end of 1907	256
,, March, 1909	919
,, March, 1910	970
,, September, 1910	1,380

Experimental Laboratories.—There are two laboratories under the management of the Company: the Central Laboratory and the Geological Laboratory. The Central Laboratory was formerly under the control of the Kwantung Government, and was taken over by the Company on May 1, 1910. It is intended principally to conduct industrial and sanitary experiments and investigations. The Geological Laboratory originally belonged to the Mining Department of the Company, but was created into an independent institution under the control of the Company on May 1, 1910. This laboratory has charge of the geological investigations in the whole of Manchuria.

Financial Statistics—The following gives the Company's capital expenditure up to September 30, 1910:—

Railway	46,970,237
Electricity	3,390,707
Gas	705,160
Harbour and Wharves	5,320,238
Mines	6,830,286
Hotels	804,309
Land Improvements	5,696,675
Buildings	8,564,698
Total	78,282,310

The following is the Company's aggregate receipts and expenditure in yen for the working half years up to September 30, 1910.

Working year.	Term.	Receipts.	Expenditure.	Net Profit.
1907	1st Half	5,002.459	4,073,863	928,496
	2nd Half	7,540,657	6,452,668	1,087,989
1908	1st Half	6,959,342	6,187,549	771,793
	2nd Half	10,656,340	9,314,553	1,341,787
1909	1st Half	9,892,575	8,206,709	1,685,866
	2nd Half	13,221,358	9,135,525	4,085,833
1910	1st Half	9,411,241	8,788,248	632,993

FUSHUN COAL MINES: ELEMENTARY SCHOOL HOUSE AT CHIEN-CHIN-CHAI

TANGSHAN ENGINEERING COLLEGE

The College, Tangshan Engineering College, was established by the Imperial Chinese Railways in 1905. In May of that year instructions were received by the Directors of the Railways from Their Excellencies Yuan Shih-kai and Hu Yen-mei, Directors-General of Imperial Chinese Railways, to draw up plans for an engineering college to be established at some point along the railway line where Chinese engineers were to be trained for service in the Railways. In August of the same year Tangshan, a town on the Railway line situated half way between Tientsin and Shanhaikwan, was decided upon as the place where the College was to be built. The presence of the railway workshops in Tangshan offered unusual opportunities to the students for practice in connection with their engineering education. Building operations were begun in October providing dormitories for one hundred and sixty students, a dining hall, two class room buildings, a swimming bath, and residences for the president and the professors. These buildings were completed and ready for the reception of students in August, 1906. For the first class students with a working knowledge of English, elementary mathematics, and Chinese literature, history and geography were examined in Hongkong, Shanghai and Tientsin in December and 120 were chosen. Regular class work, however, did not begin until March, 1907, when the students were divided in two sections of sixty members each.

DR. S. S. YOUNG, A. B., A. M., PRESIDENT OF THE TANGSHAN ENGINEERING COLLEGE.

The two class room buildings originally provided soon proved insufficient for the accommodation of the several departments, and a larger lecture hall containing drawing offices, laboratories and lecture theaters was further added. This building, now known as East Hall, was begun in May, 1907, and was ready for occupation at the end of the year. At the same time a hospital for the special care of sick students was built on a lot adjoining the college compound. Beside the hospital was also built a house for the medical officer.

During the first two years of the College's existence, the classes were handicapped by lack of equipment for practical work, but greater emphasis has since been laid on practical laboratory work in connection with lectures and text-book instruction, and in 1909 additional apparatus and equipment were acquired, which have been sufficient to satisfy the requirements of the present classes. The physical laboratory has been extended as well as the chemical laboratory, and new quarters are being provided for the latter in the new west hall, which is now in course of construction and which will be ready for occupation after the summer holidays. To provide the advanced classes with more room for practical work, a large workshop and engineering laboratories building is also being constructed and will be fully equipped by the time the students return to their classes in the fall. In this building a mechanical laboratory, a hydraulics laboratory, workshops, calorimetry room, power house boiler house, electrical engineering laboratory, photometric room and heat laboratory have been provided.

The original plan of the Directors-General of Imperial Chinese Railways was to train Chinese engineers for railway construction work only, and a course in civil engineering was offered in the college. When the Imperial Chinese Railways became the Imperial Railways of North China and came under the control of the Imperial Ministry of Posts and Communications, the College also came under direct control of the Ministry, and this year courses in Mechanical and Electrical Engineering are being added to train men in these branches of engineering as well.

In order to secure for the College Department students thoroughly grounded in the fundamental subjects, a preparatory department has been added to the college, offering a three year course. Accommodations for 150 students have been provided for this department in a new dormitory, and new students will be admitted after the summer vacation.

The college aims to offer to students the highest engineering education obtainable in the country and towards this end no pains and expense have been spared in making necessary improvements and extensions. Students graduating from the collegiate department will be employed by the Ministry of Posts and Communications and drafted into the various Government railways to serve as cadets for a term of two or three years before they are given definite appointments on the engineering staff. The first railway engineering class will graduate in July, 1911.

Entrance Requirements.—Candidates for admission to the first year of the preparatory department must have attained to the age of thirteen years. They must submit to examinations in English showing a study of the language for at least three years, and in arithmetic in English, and must show a fair knowledge of the Chinese language and literature, history and geography. Successful candidates must also pass a physical examination before they are admitted to the college.

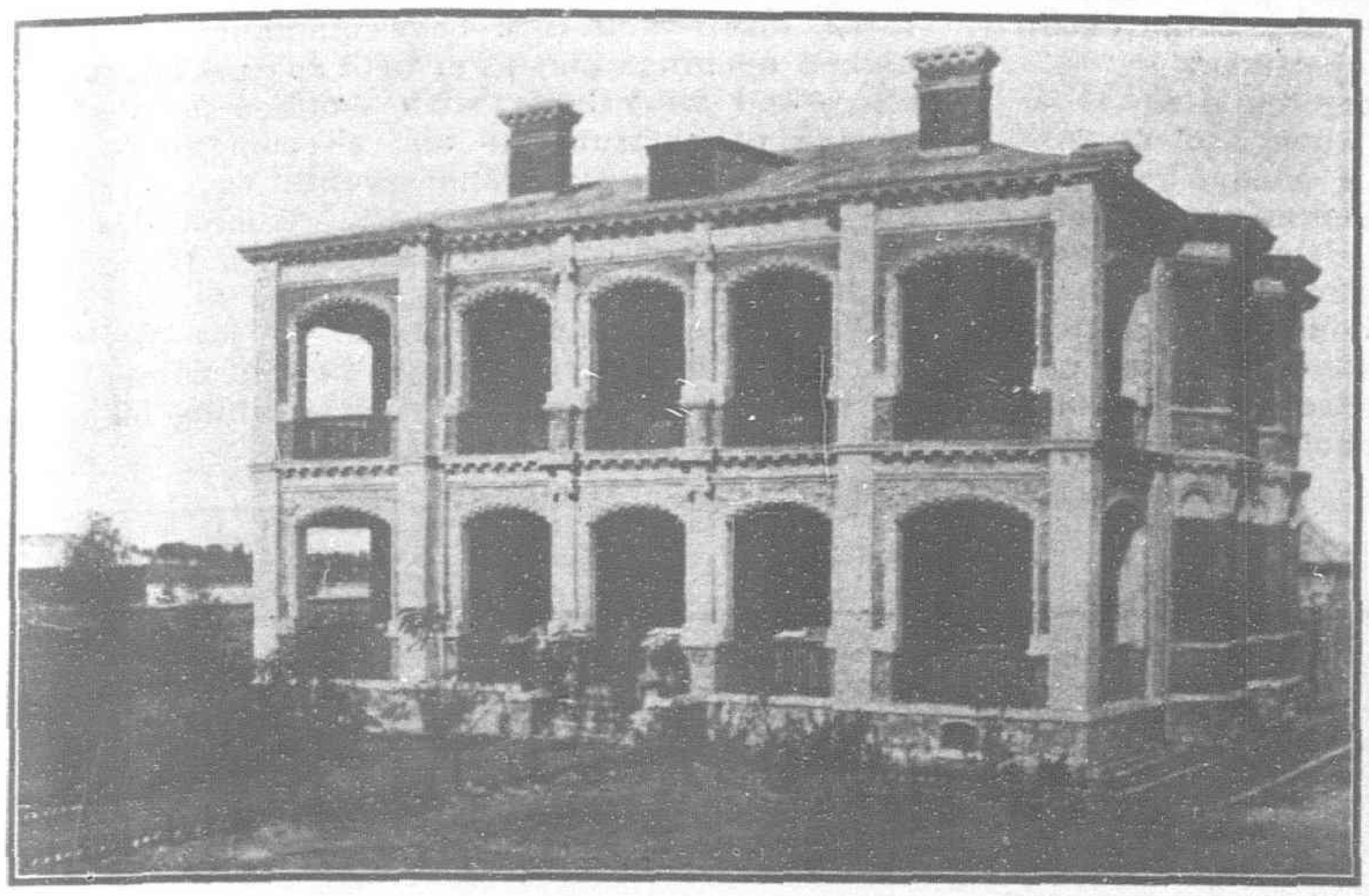
To be admitted as regular students in the freshman class the candidates must have attained to the age of sixteen years, must have passed a medical examination and examinations in the following subjects:

Elementary Algebra through quadratic equations; *plane and solid geometry:* the ordinary definitions, demonstrations and constructions; *elementary physics:* a knowledge of the fundamental principles of physics; *elementary chemistry:* a knowledge of the chemistry of the drafting instruments; *Mechanical drawing:* a knowledge of the use of drafting instruments; *English composition and conversation:* proficiency in grammar, ability to speak, read, write and translate English correctly; *history and geography:* the candidate should show a general knowledge of world history and of the geography of the world; *Chinese literature:* familiarity with the literature in the Chinese language and ability to write an essay of average length in correct style.

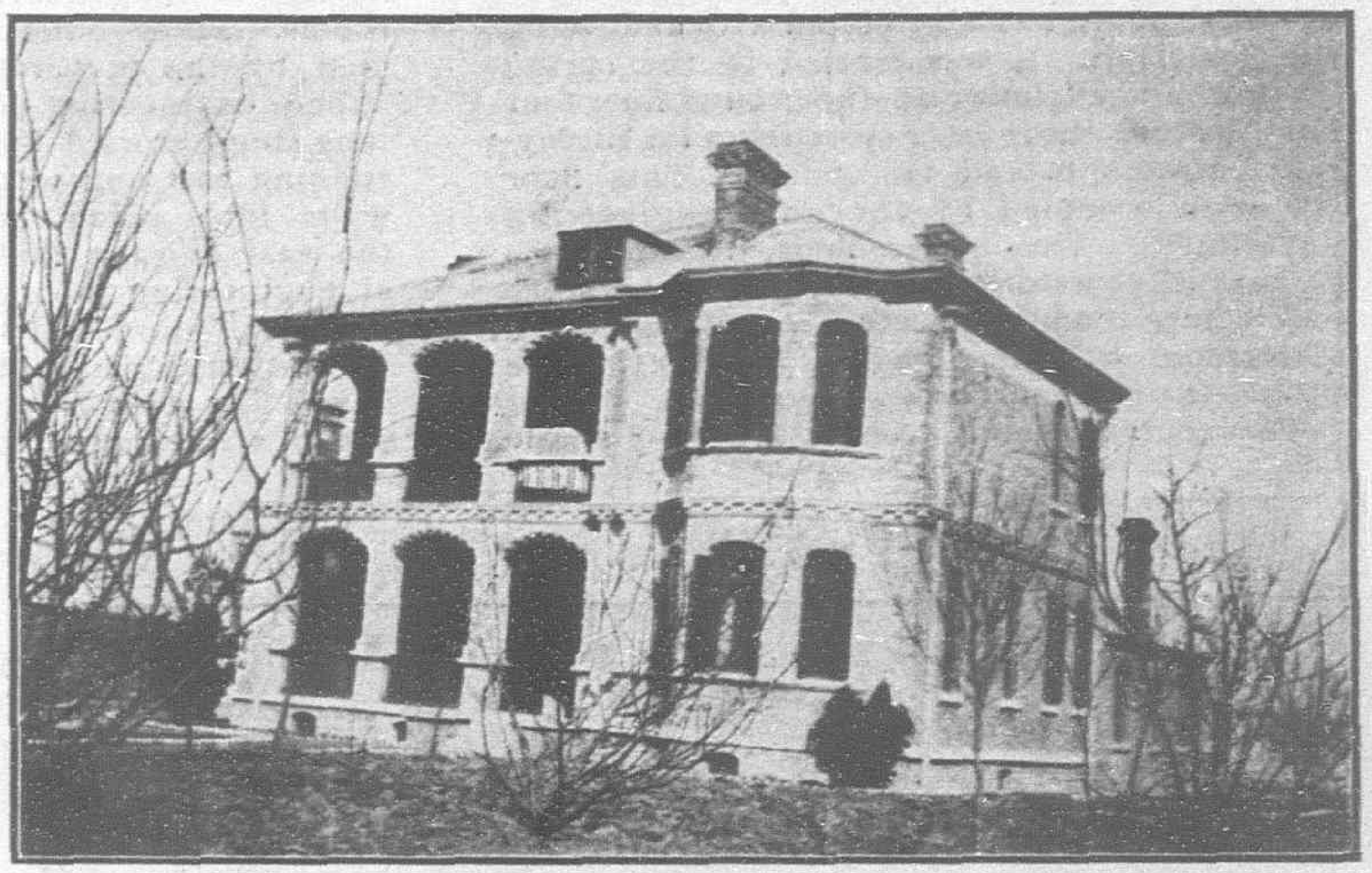
The students who have completed the course offered in the preparatory department are admitted into the freshman class without undergoing the regular entrance examinations.

Advanced Standing.—Candidates may be admitted to advanced standing in any class by showing that they have completed all the subjects required in the previous year or years of the preparatory or collegiate course which they desire to enter. Candidates for advanced standing may enter the regular final examinations in June of the class which they wish to join.

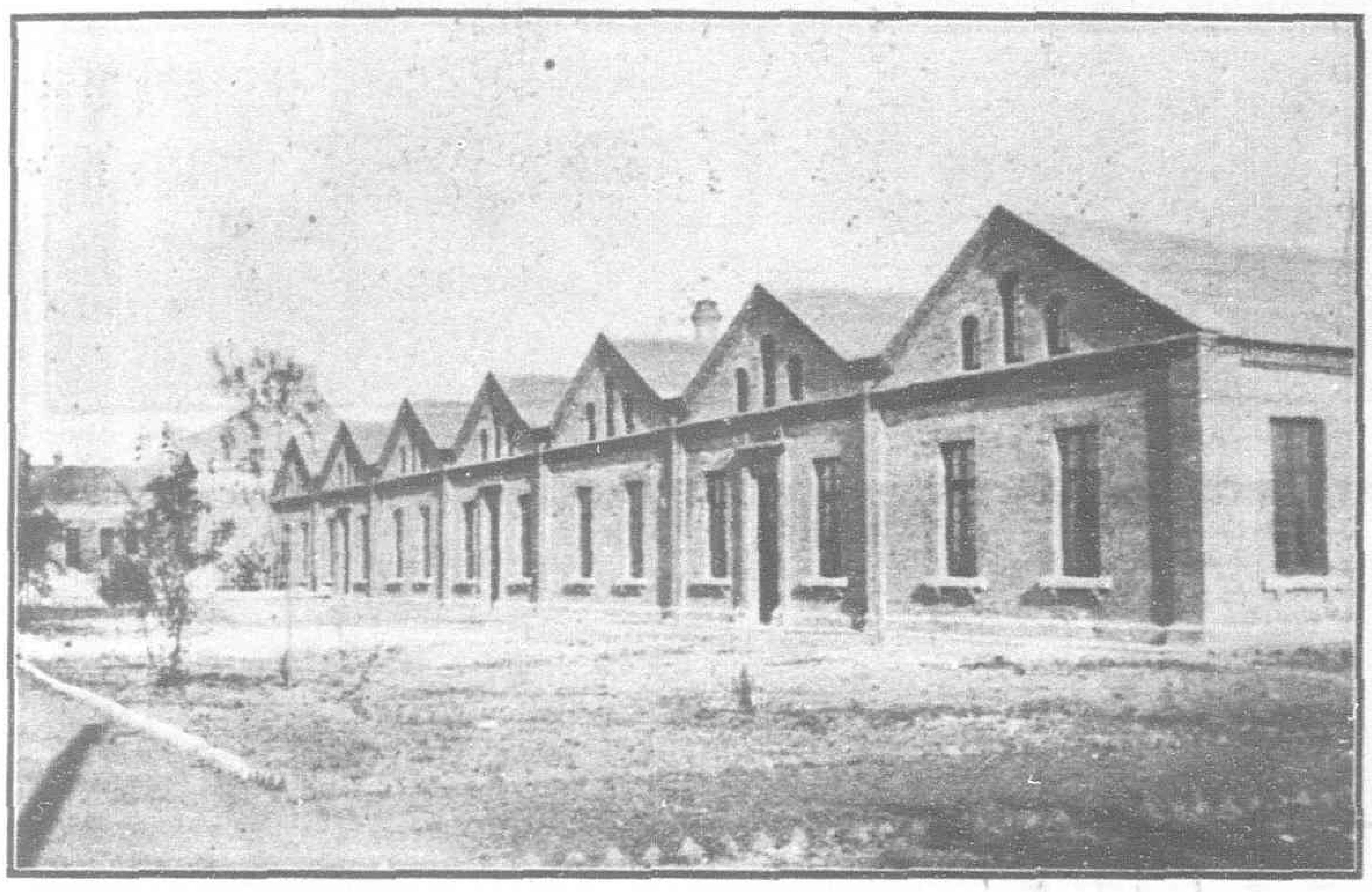
Time and place of examinations.—This year entrance examinations will be held during the summer vacation in July or August in Canton or HongKong, Shanghai, and Tientsin, at such time and in such places as will be announced in the local newspapers when the time approaches for the examinations.



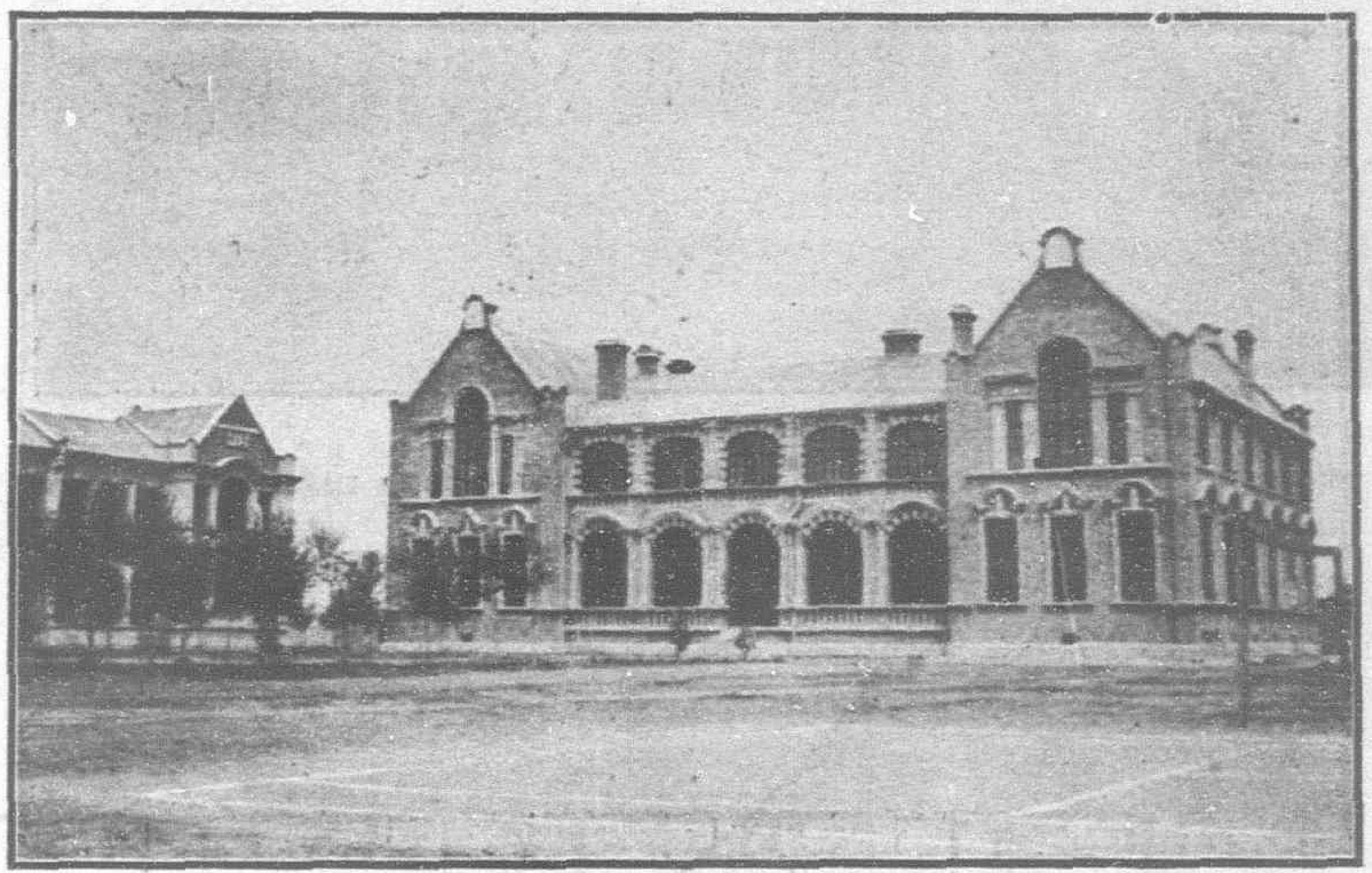
THE PRESIDENT'S HOUSE



ONE OF THE RESIDENCES OF THE PROFESSORS



ENGINEERING LABORATORIES AND WORKSHOPS CONTAINING MECHANICAL AND HYDRAULIC LABORATORIES, WOOD AND METAL WORKSHOPS, POWER HOUSE, HEAT ENGINE LABORATORY, ELECTRICAL TESTING LABORATORY AND BOILER HOUSE AND BATTERY ROOM



EAST HALL, THE UPPER FLOOR OF WHICH IS OCCUPIED BY SPACIOUS DRAWING OFFICES.—THE ROOMS OF THE LOWER FLOOR ARE USED AS GENERAL LECTURE ROOMS

Plans of Instruction.—In all engineering colleges difficulties arise in justly proportioning the theoretical and practical parts of the tuition. It must at the outset be realized that the practical work done in a college is in no sense to be regarded as replacing that which executed by a pupil in works or offices. It is only introductory thereto, and enables the student on leaving the college to appreciate the details of his practical work so that he finally becomes efficient in this much sooner than he would without such preparation. There will therefore be found in the curriculum certain periods alloted to workshop practice, drawing office work, and field work of amount sufficient to thoroughly exemplify the theoretical training but not adequate in either time or subject to fully qualify the student who completes the course to independently undertake any piece of work. The environment of works and offices is quite different from that of a college and the trained student must become acquainted with the values and proportions of things in actual practice before he can be considered a real engineer.

With regard to the theoretical courses, engineering must be regarded as the application of physical science. Physical science depends on two things: (1) mathematics and (2) experiment. The mathematical training proceeds continuously from the first year of the preparatory course up to the sophomore year, after which it does not appear as a separate subject, but is specialized in the various technical subjects. It is not so essential that an engineer shall be a first class mathematician as that he shall have a sound knowledge of the principles and applications of mathematics to simple problems, including those which involve continuous change in time and space.

Experimental science is gradually developed from the very beginning of the courses. Chemistry, physics, and geology are studied in lecture room and laboratory up to the Junior year when they give way to their applications of engineering practice.

The technical work is gradually introduced, displacing one by one the mathematical and purely scientific subjects upon which it wholly depends and is after the Sophomore year specialized in three directions according to the type of engineering training required by the student. The three types are: (1) civil, (2) mechanical and (3) electrical. It is not possible to rigidly separate the types and in many subjects the lectures, laboratories and drawing office work overlap and are common to two of the types, but wherever there are distinct subjects to be studied special courses of lectures are arranged.

In the last year of the student's course he is required to write a thesis, i.e., a special study of or attempt to solve a certain engineering problem. The exact nature of the work to be done will be decided by the respective professors, some choice, however, being allowed to the student. The execution of this thesis will as far as possible involve the application of all the theoretical and practical knowledge the students acquired.

In connection with all the subjects of the courses it should be particularly observed that the subjects are only separated for convenience, and are in actual fact all dependent on each other, forming an organic whole and not a number of rigidly distinct parts.

Accommodations.—The buildings of the College may be divided into two classes: (1) educational and (2) residential. The educational buildings are: The east hall, the west hall, the central lecture rooms and the engineering laboratory building.

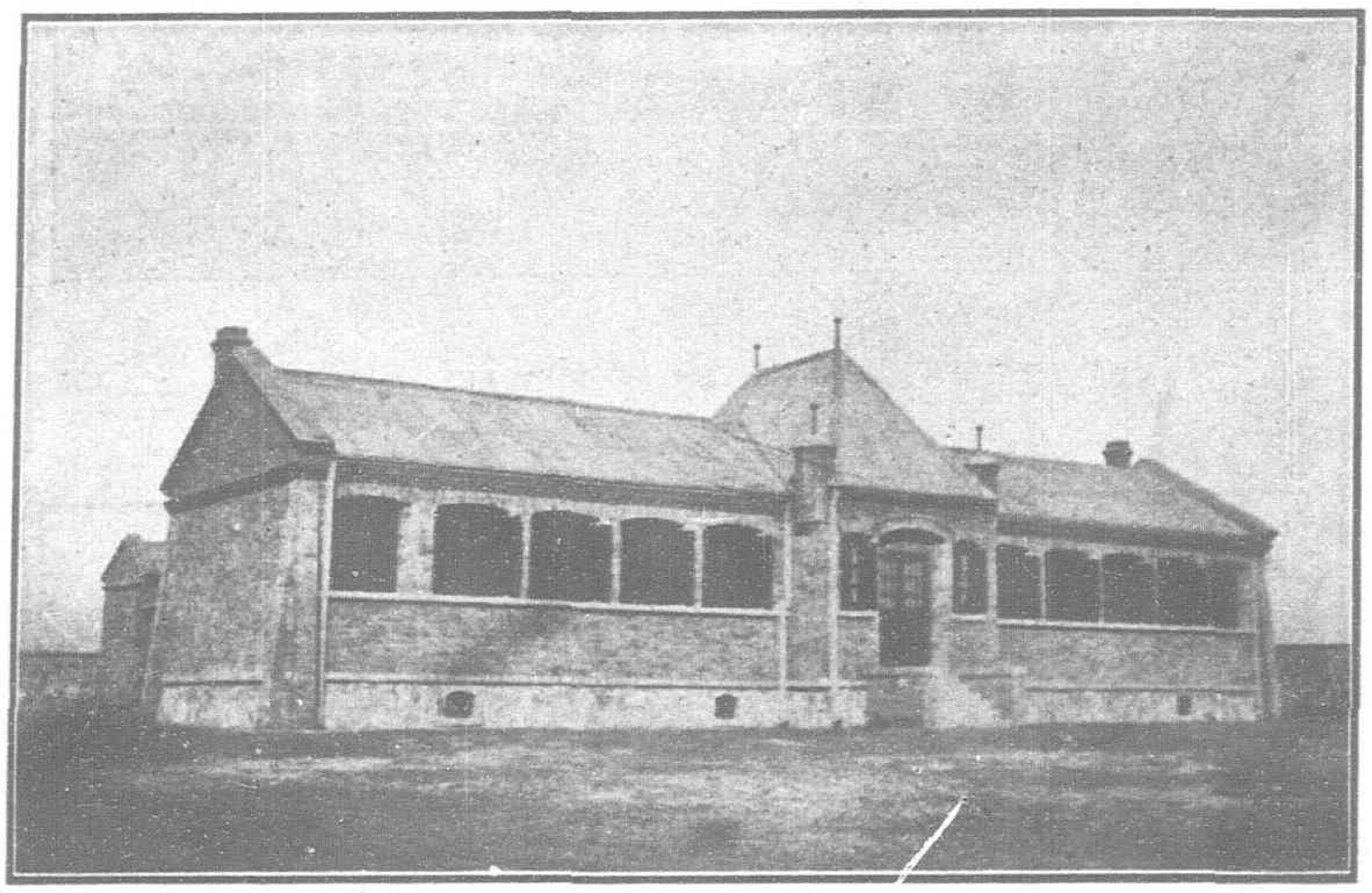
East Hall is a two-storied building, 130′ by 60′, running north and south and facing to the west. It was erected in 1907 and includes on the ground floor three lecture rooms and physical laboratory. This floor is occupied by the physical and mathematical departments and there are three offices for professors and instructors. There is also a room for the storing of Physical apparatus adjoining the Physical laboratory. On the first floor there are two large drawing offices and a lecture theater. This floor is occupied by the mechanical engineering department and contains an office for the professor. There is also a dark room for photoprinting and another similar room on the mezzanine floor.

West Hall is a two storied building, 129′ 6 by 76′ 0″, symmetrically placed with and facing the East Hall. It was erected in the spring of 1910, and includes on the ground floor four large lecture theaters, a store room for surveying instruments and two offices. This floor is partly occupied by the civil engineering department. The upper floor includes two chemical laboratories, a geological laboratory and lecture room, two lecture rooms, a chemical store room, a balance room and office for the professor of chemistry and geology.

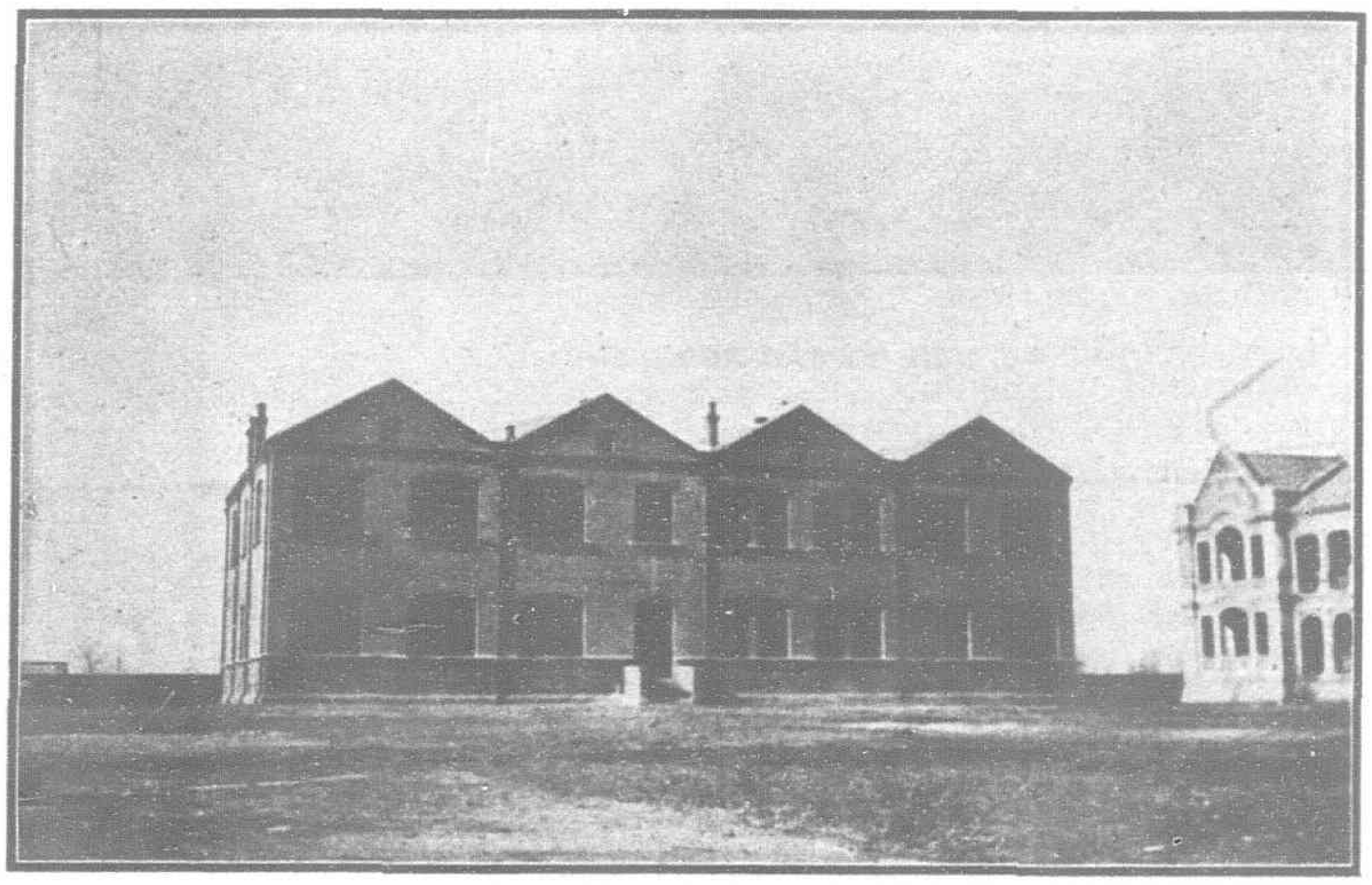
The central lecture rooms are two single storied buildings, each containing two lecture rooms. These buildings are now being occupied by the preparatory department.

The engineering laboratory building is a long single storied building about 220′ by 70′ running east and west. It is divided by cross walls into seven bays. Commencing from the east end the first bay includes electrical engineering laboratory. South of this bay is a coal store and boiler house which latter is continued across the end of the second bay. The second bay is subdivided into three parts, viz., engine room, photometric room, and electrical instruments testing room. The third, fourth and fifth bays communicate by arched openings and form heat engines laboratory and workshops, with sections for the storing of instruments and a room for calorimetry. The sixth and seventh bays form the hydraulics and mechanical laboratories. The equipment of these laboratories is described below.

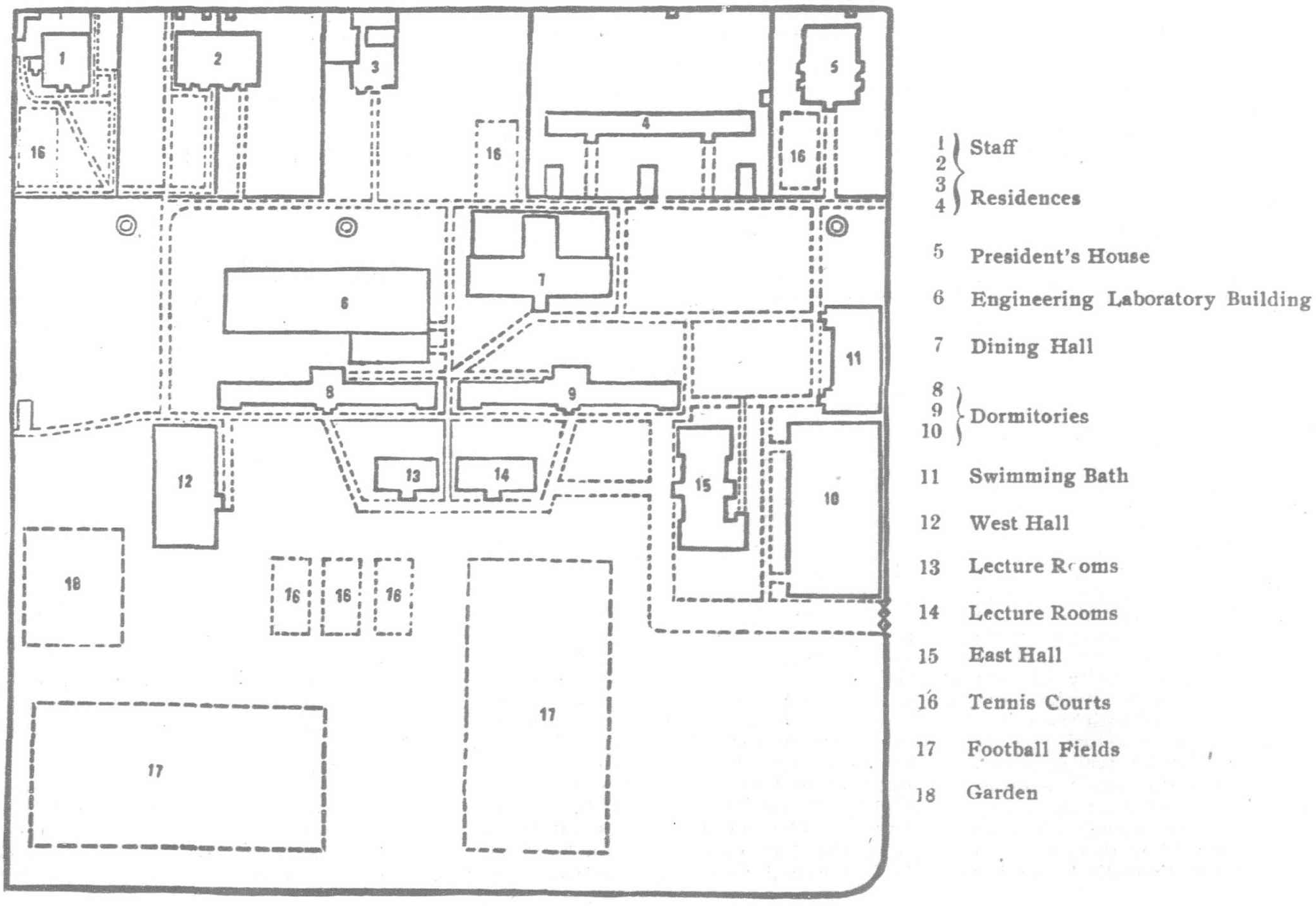
The residential buildings are: (1) east dormitory, (2) west dormitory, (3) new dormitory, (4) hospital and dispensary, (5) dining hall and library, officers' residences.



THE COLLEGE HOSPITAL CONTAINING FOUR WARDS, A DISPENSARY AND DOCTORS' CONSULTING ROOM



WEST HALL HOUSING THE CIVIL ENGINEERING, PHYSICAL AND CHEMICAL DEPARTMENTS



PLAN OF THE COLLEGE GROUNDS

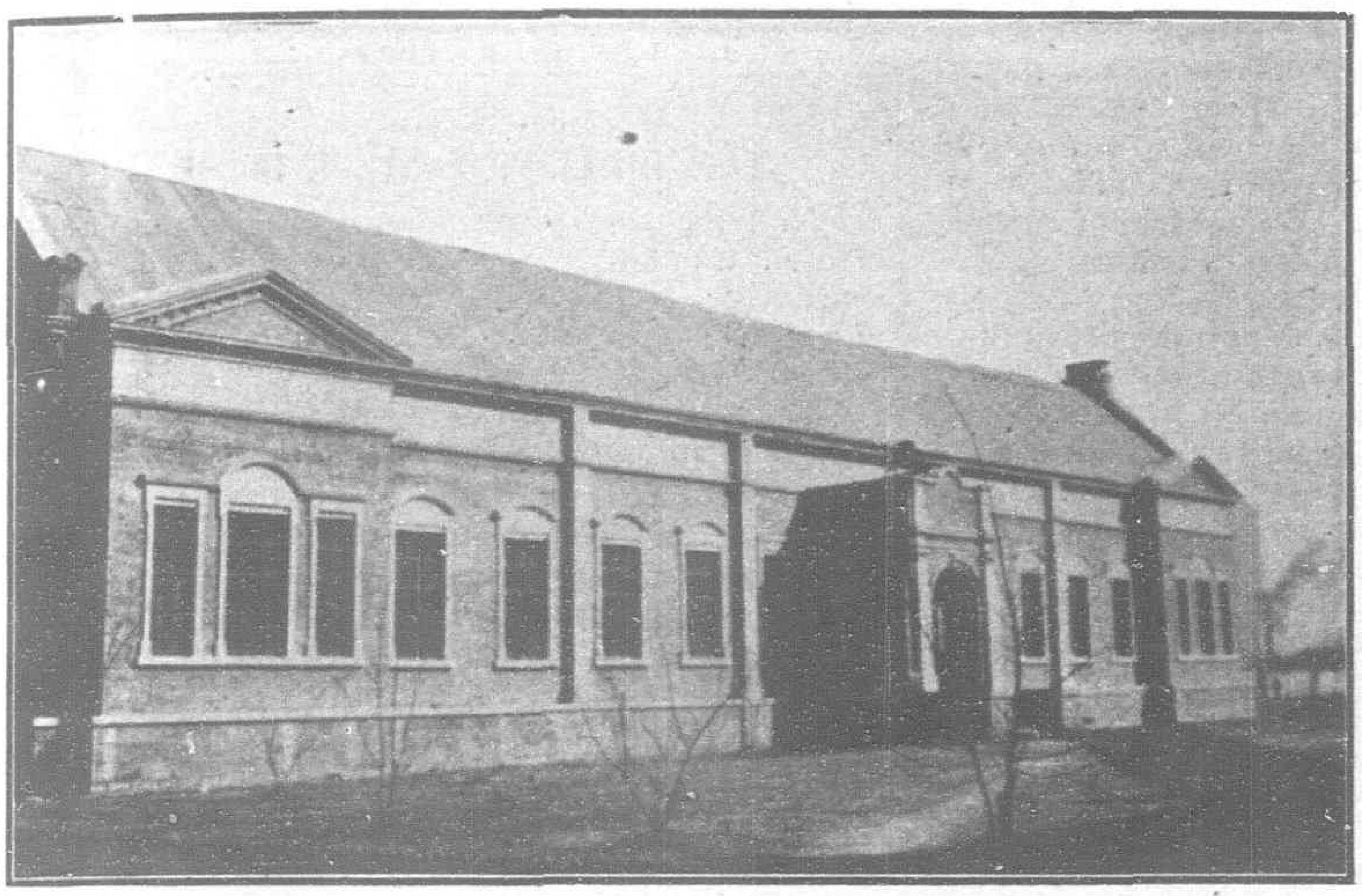
The east and west dormitories were erected in 1906 and accommodate 160 students. They are long two storied buildings facing south. Each building contains forty rooms (each for 2 students), in front of which are wide verandahs. There is an annex to each building including bath rooms and sanitary accommodations. The new dormitory near the east wall, erected in the spring of 1910, is a single storied building consisting of two rectangular enclosures surrounded with rooms. There are accommodations for 128 students in 32 rooms. Additional servants' rooms, stores, and bath rooms are provided.

The hospital is a single-storied building situated in a separate compound adjoining the college grounds, and contains four bright and airy wards, a dispensary, and operation room, a consultation room and servants' quarters. The dispensary and operating room are stocked with all the ordinary drugs and instruments.

The dining hall is a large building with fine open hammer beam roof, situated to the north of the east dormitory. It is divided into two parts, the western room containing the college library and the eastern room serving as dining hall. Kitchen and servants' quarters are attached to this part of the building.

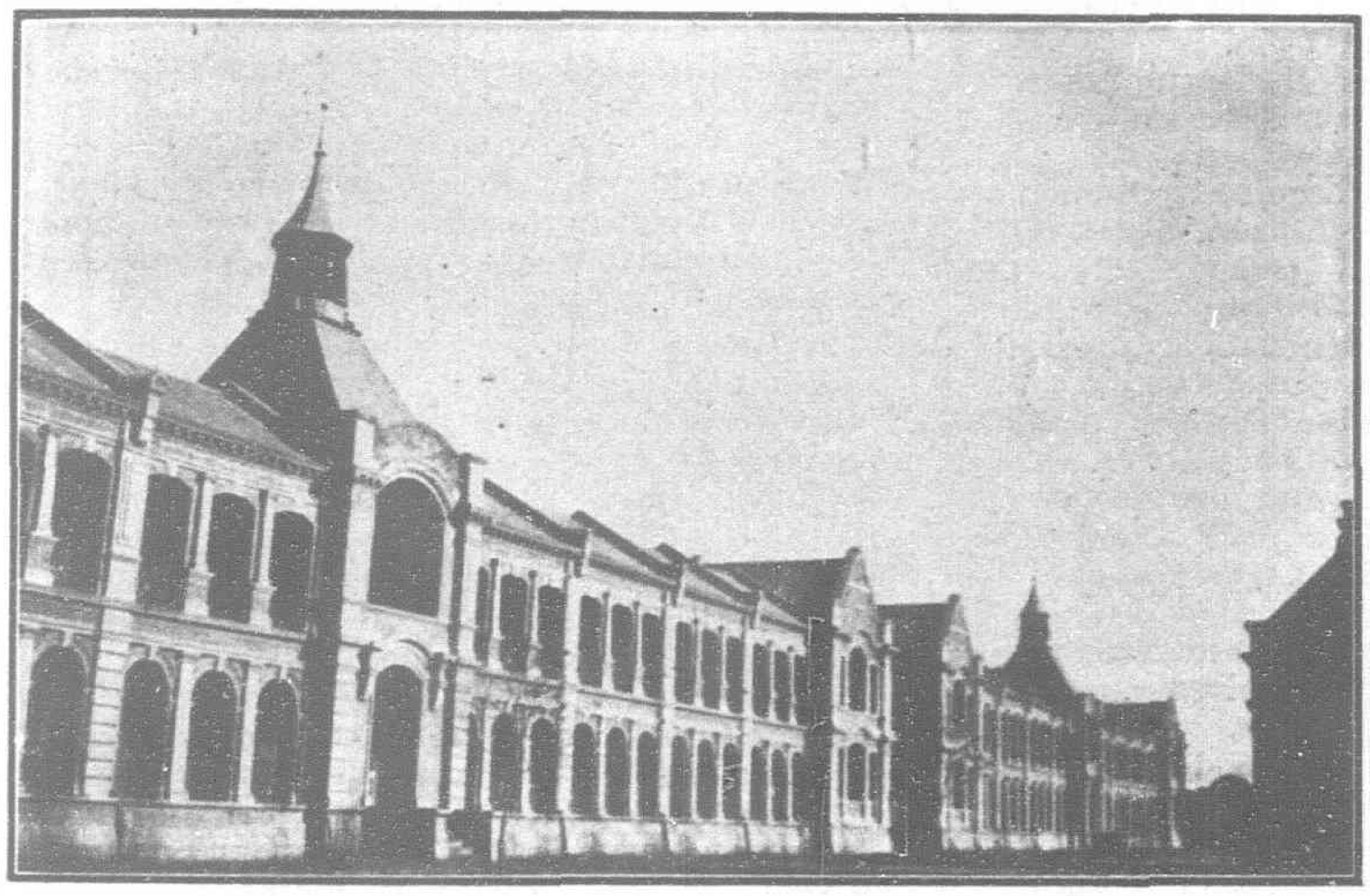
There are foreign residences situated along the north wall of the compound for the president, professors and officers of administration. The residence of the college medical officers adjoins the hospital.

The southern part of the college compound is used as an athletic field. There is an oval

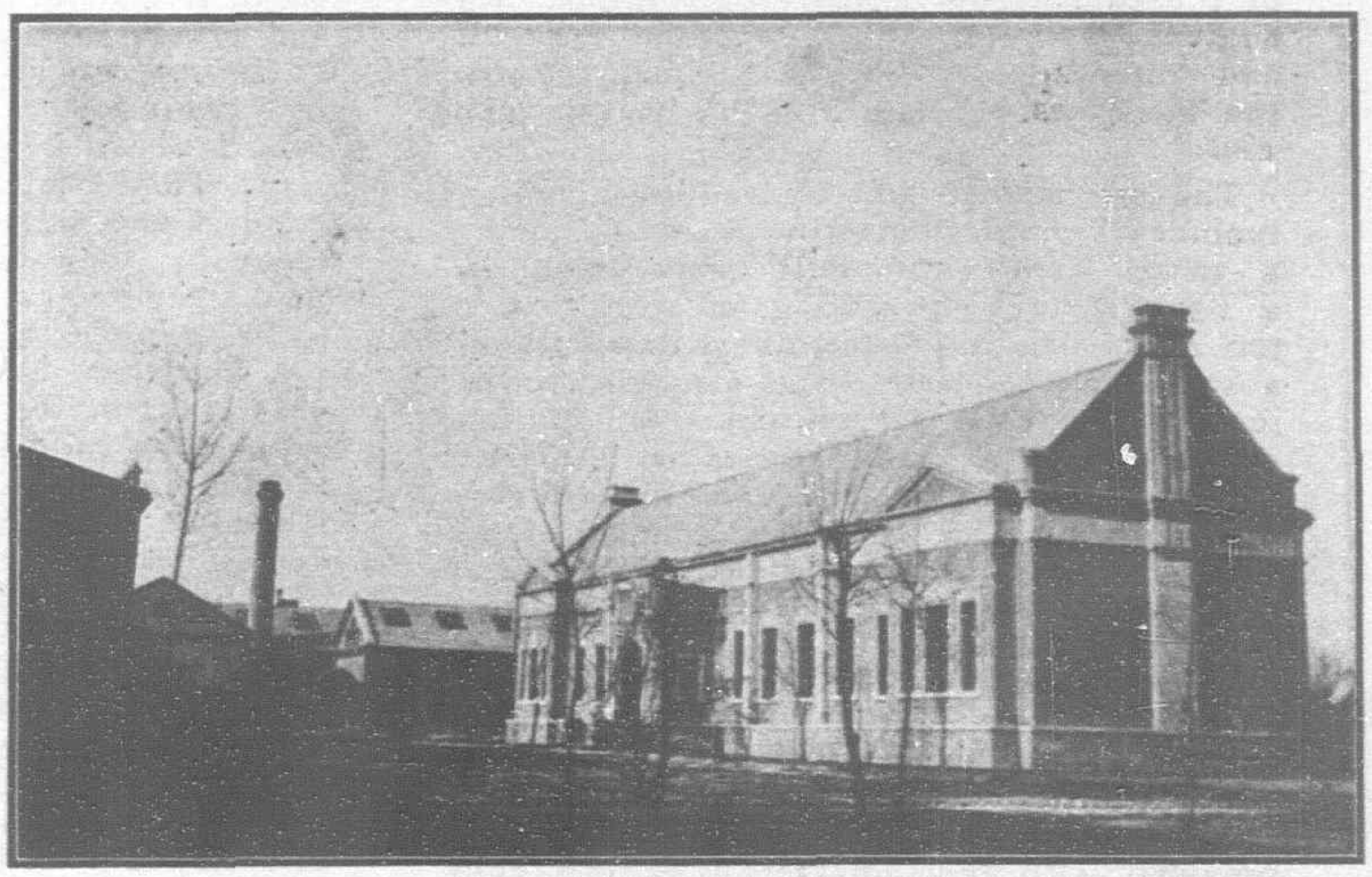


FRONT VIEW OF DINING HALL

WEST HALL AND THE LIBRARY BUILDINGS

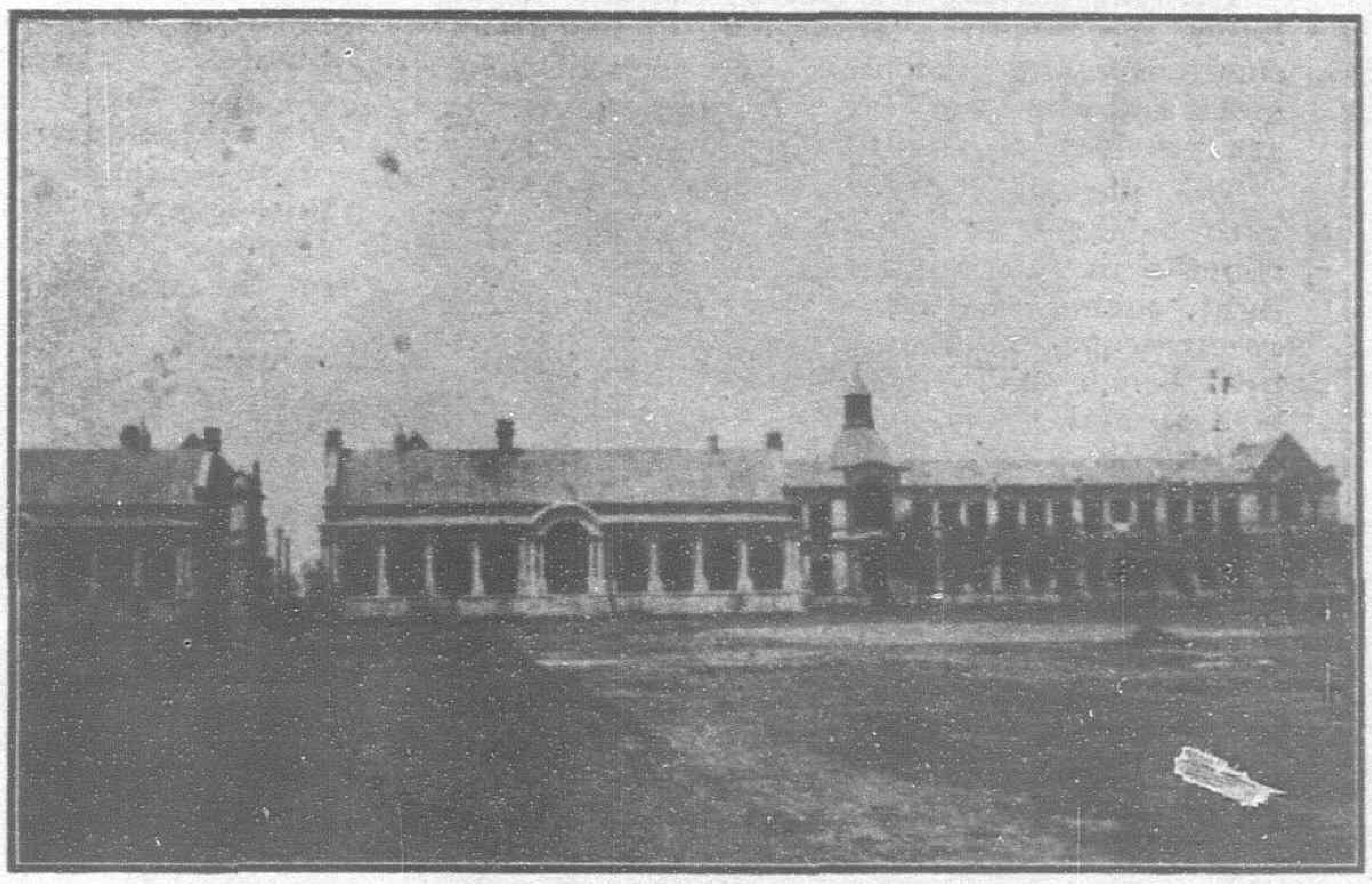


LOOKING ALONG THE FRONTAGE OF THE DORMITORIES



THE POWER HOUSE AND DINING HALL

THE INTERIOR OF THE GENERAL READING ROOM



FACING THE LIBRARY AND THE DORMITORIES

cinder track a quarter of a mile long, enclosing a football field, tennis court, cricket pitch and spaces for jumps, vaults and weight throwing.

Equipment.—The equipment of the laboratories and workshops of the college is of as varied and extensive a character as possible. It has not so much been desired to possess large machines of impressive appearance as to obtain the greatest possible variety in the representative types. The apparatus can be briefly classified as follows: (1) east engines laboratory; (2) mechanical and hydraulic laboratory; (3) electrical laboratory; (4) engineering workshop; (5) phsyical laboratory; (6) chemical and geological laboratories; (7) demonstration apparatus for civil engineering, including surveying.

The main feature of the heat engines laboratory is the 40 H. P. generator set. This consists of a double expansion condensing Howden engine (marine double) direct coupled to Crompton four-pole D. C. dynamo. The steam for the boiler is produced in a Babcock and Wilcox water tube boiler fitted with Green's Fuel Economiser. A petrol motor pump set supplies the water for the engine room, drawing the same from a large well in the center of the north end of the college enclosure. The water is stored in a large underground tank extending between the engine room and hydraulic laboratory, which latter room is also supplied from it. The lighting of the buildings and the power for the motors attached to the various machines is obtained from the generator set mentioned above. The main switchboard is divided into three panels serving respectively the generator and battery control, lighting and power, and a small generator set. A battery of accumulators serves for the maintenance of the current during the night. The heat engines laboratory also contains indicators and other apparatus for experimenting with the machines, and on applied heat in general.

The mechanical and hydraulics laboratory includes several interesting items. There is a 30-ton Riehle automatic testing machine, a 2-ton Bailey wire and gauge tester, a 2-ton Avery bending tester, Avery impact tester, a small torsion tester, and also an oscillating torsion tester for experiments on fatigue of metals. The bench apparatus is chiefly on the Cusson's steel tripod and block system and aims principally at developing a knowledge of stress and strain, statics, friction and especially the dynamics of rolling stock and rotating bodies. In the hydraulic section there are experimental tanks, pressure pumps, hydraulic press, accumulator, centrifugal pump, Vortex turbine, Pelton wheel, and an experimental main with meters and gauges. The electrical engineering laboratory is well provided with galvanometers of various types, resistance boxes and the usual electrical instruments as well as motors for testing and demonstration.

The engineering workshops include wood lathes, screw-cutting lathes, drilling machines, small shaping machine, and benches for metal and wood working A forge and cupola are provided in the foundry.

The physical laboratory is well provided with balances and full equipment for experiments in the properties of matter, heat, light, sound, magnetism and electricity. A spectroscope, photometric apparatus and optical bench should specially be noted. There is a special room for photometry including a pentane standard lamp in the engineering laboratory building.

The chemical laboratory is supplied with apparatus and materials for elementary experiments and volumetric and gravimetric analysis of an ordinary type. A geological laboratory including several hundred specimens of rocks, minerals and fossils is attached, and all necessary instruments are provided for their examination, including microscope, goniometer, etc.

The apparatus in the civil engineering department includes theodolites and telescopic levels, tacheometer, sextants, plane tables of different makes, sufficient to equip a railway reconnaissance party for a large survey.

Models of constructional plants for lecture purposes should also be mentioned in this connection.

Division of the college year.—The college year begins in August and consists of about forty weeks, which are divided into four quarters of nine weeks each of class-room work. The last week of each quarter is devoted to quarterly examinations.

There is a summer vacation of forty days and a New Year vacation of thirty days, besides holidays on the occasion of the dragon boat festival, the mid-autumn-festival, anniversary of the birthday of Confucius, and the winter solstice. About three weeks of the summer vacation are devoted to summer practice in railroad construction, machine work or electrical work. Whenever practicable part of the New Year vacation are also given to practical work.

Expenses.—In the preparatory department the fee for tuition is twenty four dollars per year, payable semi-annually in advance before the students are admitted to classes. The fee for board and room is twelve taels per quarter, payable quarterly in advance. Physical culture and military uniforms will be supplied by the college at cost price.

In the collegiate department students admitted from the preparatory department are exempted from the payment of tuition and board fees. Intrants from other schools pay a tuition fee of four taels, and board and room fee of four taels each month during the first quarter of their freshman year, these fees being payable for three months in advance. They are exempted from payment of tuition fee after the first quarterly examination in which they shall have attained to a general average of fifty per cent. and are further exempted from payment of board and room fee after the second quarterly examination in which they shall have passed above a general average of fifty per cent. These students then become government scholars and are furnished tuition, board and room by the government free of charge. Books. stationery, and uniforms are, however, to be supplied by the students themselves.

A deposit of five dollars per course per half year is required of all students taking courses in physics and chemistry. They are charged for breakage of apparatus and for damages, for which deductions will be made from the deposit. Those whose breakages amount to over five dollars will be charged accordingly.

Examinations.—Written examinations as well as examinations in practical courses are held at the end of each quarter. A general average of fifty per cent. and at least thirty per cent. in every subject are required for a pass mark. No student failing to attain to this standard will be promoted to a higher class. The final marks for a college year are obtained by taking the average in every subject of the marks given in the four quarterly examinations.

There are at present in the college a total number of 170 students divided into 5 classes, 4 of the collegiate department and 1 of the preparatory department. The first class of 28 students will graduate from the college this summer and after graduation will be employed by the Board of Communications on the various railways under its control.

List of Professors and Officers for 1911.—Samuel S. Young, A. B. (California), A. M. (Columbia), Ltt. D. (Imperial Chinese Government), president; James A. Cormack, B. Sc , C. E. (Glasgow University), professor of mechanical engineering; David Thomas, B. E. (Sydney University), professor of chemistry and geology; Charles J. Adderley, B. A., B. A. I. (Trinity College, Dublin); professor of physics and civil engineering; Herbert Chatley, B. Sc. (London), professor of civil engineering; Frank A. Foster, B. S. (Worcester Institute of Technology), assistant professor of mechanical engineering; Fred C. Eaton, B. S. (Cornell), acting professor of mathematics; Alfred C. B. Fletcher, B. S. (California, acting professor of English; Luther McLean Jee, B. S. (California), A. M. (Harvard), professor of economics and history; Pond Mooar Jee, B. S., M. D. (California), medical officer and director of physical culture; Ho Hou wei, B. S. (Yale), A. M. (Pennsylvania), professor of mathematics; Tang Dien-san, M. A. (Chinese), professor of Chinese literature; Ch'en Ying-chung, M. A. (Chinese), reader in Chinese composition; Su Wen-ching, assistant in drawing.

Ch'en Hung-chi, head proctor and accountant; Chang Tseng-ching, general supervisor and secretary; Li Cho-chun, proctor; Wei Shang-chi, proctor; Hsu Shu-pei, storekeeper; Chin Cheng-chu, recorder; Chang Li-hsun, clerk; Lu Chung-lin, clerk.

THE PHILIPPINE SOAP INDUSTRY

That local soap manufacture has been neglected was largely due to the fact that foreign initiative was lacking. The importation of foreign soaps offered handsome returns and the advantages of industrial adventure in this department of industry in the islands did not prove of sufficient attraction.

Since American occupation, however, the demand for better quality of soap, formerly confined to foreigners and the better class of natives, increased by leaps and bounds. Importations of soaps increased yearly and especially in 1910 when the total importation was valued at ₱231,516 as against ₱136,348 in 1909

The Philippines offers the greatest natural inducements for the growth of this industry due to the availability of cocoanut oil, a most desirable ingredient, and the climate. But notwithstanding all the favorable conditions, the export of copra to Marseilles and the import of the foreign article continued until recently when the Philippine Soap Co. was organized with a capital of ₱100,000 for the purpose of developing this important industry. The officers of the company are Thomas J. Wolff, president; L. F. Goodale, vice-president; and J. Williamson, secretary-treasurer. Ramon Rius, a Spanish soap expert, has been engaged as manager.

President Wolff is also head of the Sanitary Steam Laundry Co. that has met with a large measure of success in building up a thriving business.

Manager Rius has been connected with the leading soap manufacturing concerns in Spain, France and Italy. He served his apprenticeship in Reus, Spain, studied all the different branches of manufacture in Marseilles and perfected his knowledge of the adaptation of the different oils and greases to the most economical means of producing the best returns in quality. After becoming conversant with French manufacture, he proceeded to Italy where he spent a number of years in study of Italian methods. In all Mr. Rius has had over 15 years' experience in different capacities up to the management of factories and is thoroughly conversant with the most approved modern methods of manufacture of all grades.

The new company has established itself in the building now occupied by the laundry but has arranged for a new site upon which a large reinforced concrete building is being constructed and will be occupied in a few months.

Machinery was installed early in June and the factory began operations June 15. Its capacity is 200,000 pounds a month and several units will be added as the demand increases. At the present time the entire output has been contracted for and new machinery to increase the capacity of the plant has been ordered.

It is the purpose of the company to cater to Far Eastern trade as soon as facilities are increased to take care of it. From present indications it will be some time before the local demand will be covered, but President Wolff proposes expanding until he has his share of Oriental business. He believes he can compete successfully with European and American products in point of quality and price in any market.

IMPERIAL TAIWAN RAILWAYS

Over thirty years ago in 1877, while China was bitterly opposing the introduction of the steam railway into her territory, there was a wide awake and progressive Governor in Formosa by the name of Ting who foresaw the advantages of the new means of travel, and urged upon Peking a program for the construction of railways. But the wise old mandarins at Peking refused to sanction the proposition and when the little Woosung line was torn up, and the Chinese were looking for some secluded spot to relegate the wreck, the Island of Formosa was chosen, and the materials were dumped there probably as an object lesson to the progressive Governor, and to emphasize the antiprogressive attitude of the Government,

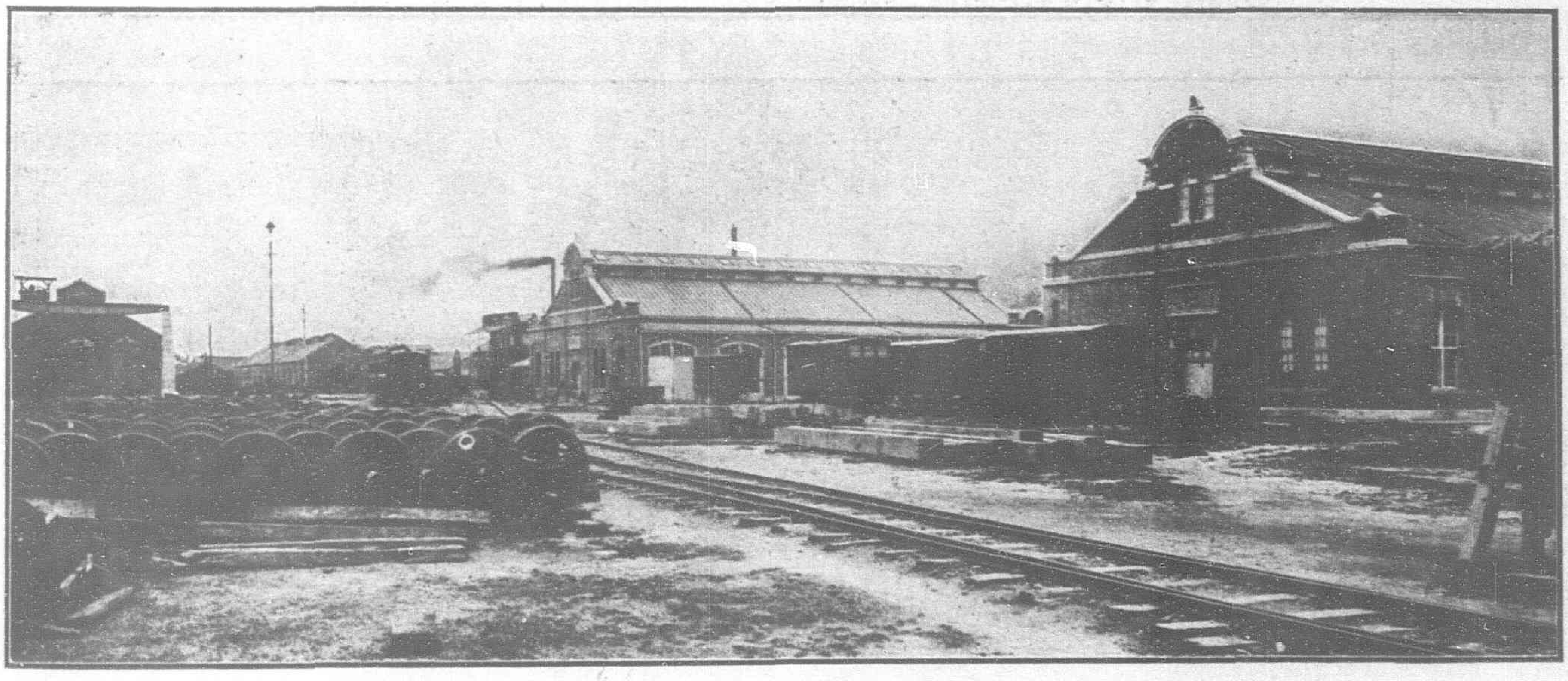
The removal of the capital of Formosa from Tainanfu on the coast to Taipeh on account of the danger from invasion served Governor Liu Ming Chuan, who had succeeded Ting, as an excuse for the construction of a railway connecting the capital with the coast. He managed to build twelve miles connecting Tuatutia and Saitingka, and this section was opened to traffic in 1889. Even this small section was evidence of the te-

Mr. KATICHI UCHIDA

CHIEF OF CIVIL ADMINISTRATION AND DIRECTOR OF THE IMPERIAL TAIWAN RAILWAYS.

Mr. SHIKANOSUKE NIIMOTO

CHIEF ENGINEER OF THE IMPERIAL TAIWAN RAILWAYS.

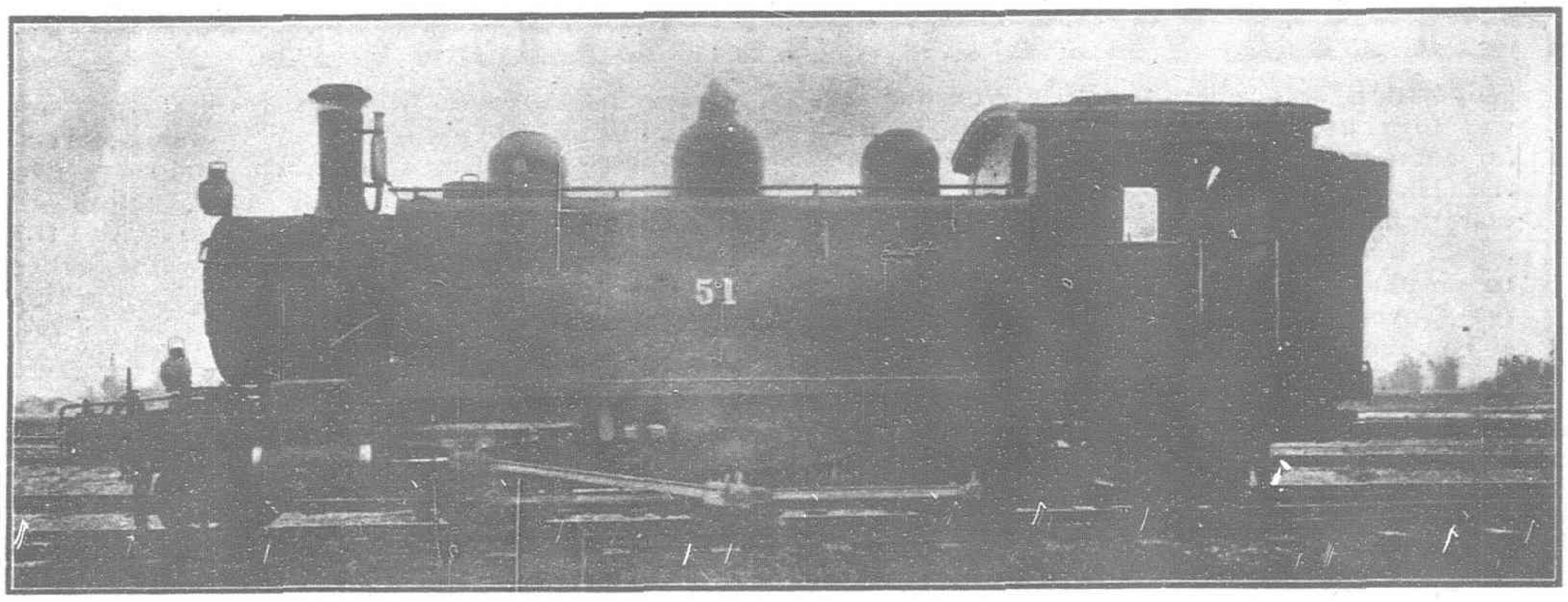


THE EXTENSIVE RAILWAY SHOPS AT DAIHOKU ON THE IMPERIAL TAIWAN RAILWAYS nacity of Governor Liu Ming Chuan in battling with the prejudice at Peking against the innovation. The work was continued until 1893 at which time the line was completed and opened to traffic for a distance of 62 miles connecting Hsinchu with the Northern Port of Keelung. At this period of railway construction the Peking government issued an order to suspend further operations, the proposal to improve the Port of Keelung was not encouraged and trade fell off. In fact all the collieries were closed and, with the exception of passenger traffic, there was little activity in transportation.

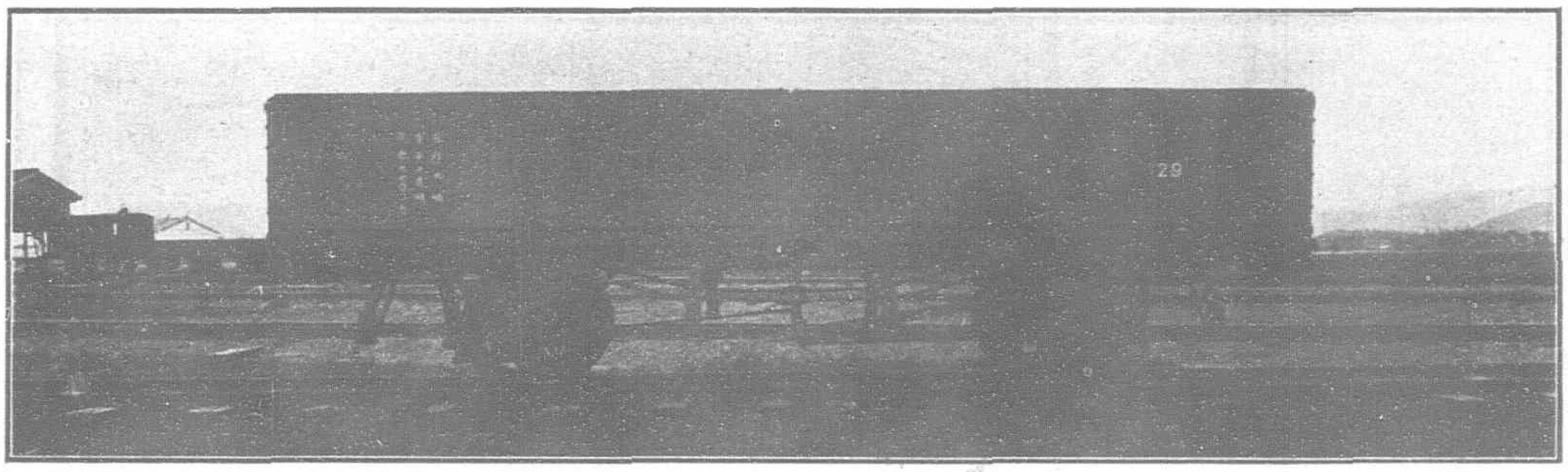
When the Japanese assumed control of the island after the Chino-Japanese War they found the 62 miles of railway built by the Chinese Government in operation joining Keelung and Shinchiki. This line represented a cost to the Chinese administration of approximately 1,295,960 taels, and through lack of encouragement by the Peking Government it had not been properly maintained, although Governor Liu Ming Chuan, the progressive executive, used every influence to extend the line and keep it in good shape. His resignation in 1891 concluded all progress in any direction and when the Japanese assumed control in 1895 and decided to extend the railway it became necessary to reconstruct the 62 miles to which they fell heir.

After the Japanese occupation of the Island in 1895, a special survey was made for the extension of the existing railways under the supervision of the Civil Affairs Department which controlled for three years the Tem-

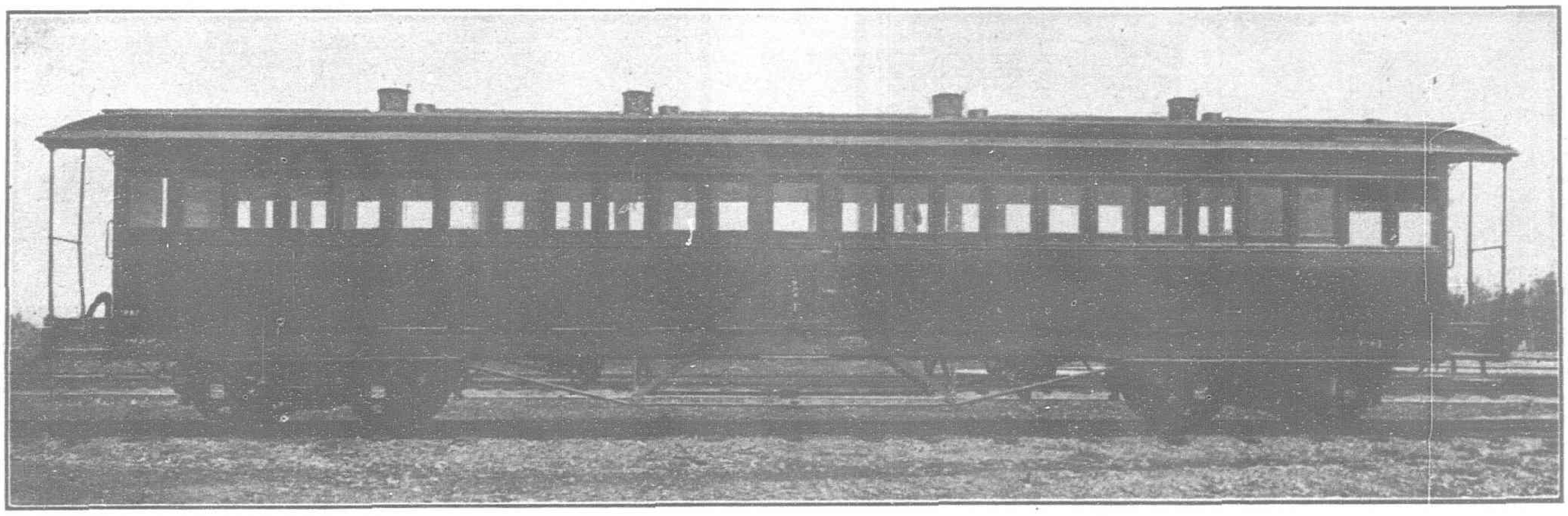
(Continued on page 127)



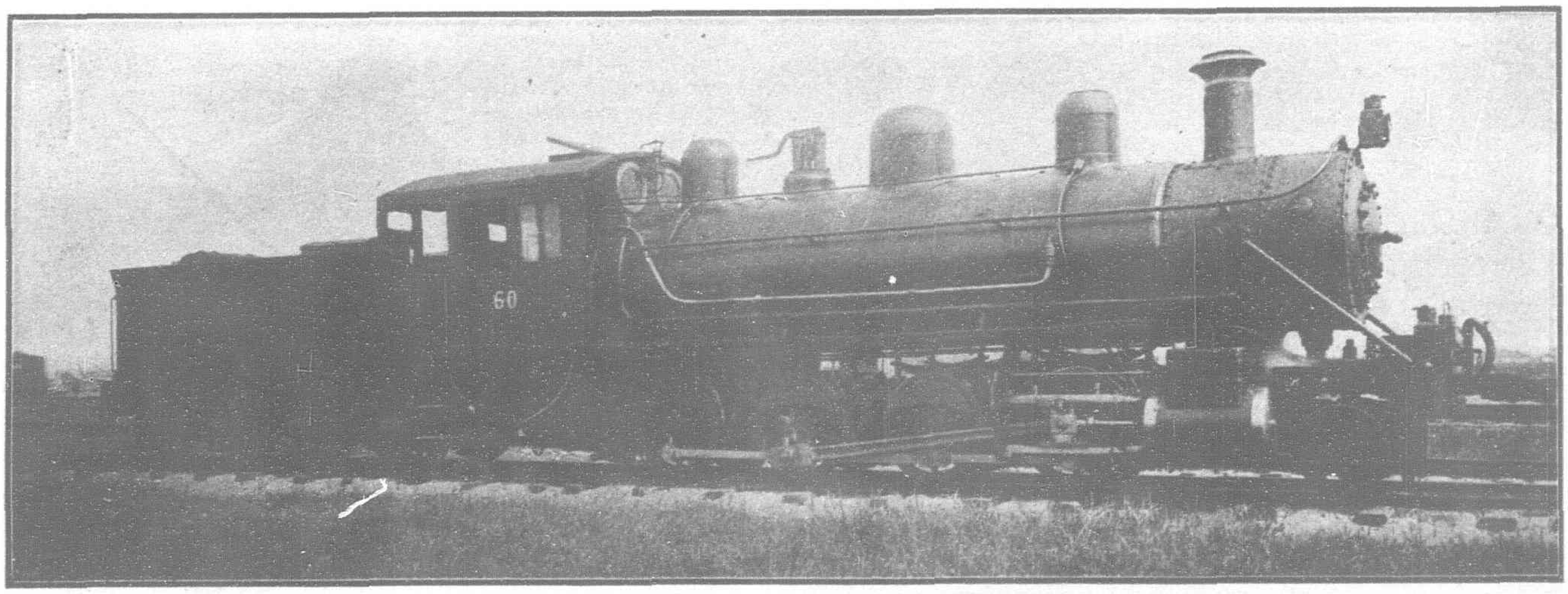
LOCOMOTIVE (2-6-2) BUILT BY THE OSAKA KISHA SEIZO KAISHA FOR THE IMPERIAL TAIWAN RAILWAYS. GROSS WEIGHT 48 TONS



FREIGHT CAR BUILT BY THE OSAKA KISHA SEIZO KAISHA. WEIGHT 12 TONS



IMPERIAL TAIWAN RAILWAYS.—PASSENGER COACH BUILT AT THE DAIHOKU SHOPS



IMPERIAL TAIWAN RAILWAYS.—LOCOMOTIVE (2-8-0) BUILT BY THE BALDWIN LOCOMOTIVE WORKS.—GROSS WEIGHT 73 TONS

THE FAR EASTERN REVIEW

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RECIPROCITY AND THE PHILIPPINE ISLANDS

A brochure under the caption "Reciprocity and the Philippine Islands", by Harold M. Pitt of Manila, recently issued for distribution jointly by the Philippine Government and the Manila Merchants' Association, contains a comprehensive review of the beneficial results of the Payne Bill and urges upon the commercial interests of the United States the opportunities for investment in creative insular enterprises and the promise of large return in legitimate expansion of American trade in American territory.

A foreword is offered by the Hon. Chas. B. Elliott, Secretary of Commerce and Police, as follows:

"The Philippine Islands have now reached a point in their economic development when the attention of the public should be called to the business opportunities which are here presented. Questions of a political nature may be regarded as substantially settled. The business and working people are as a whole contented and willing to do their part toward bringing about a condition of economic prosperity.

"Believing that the dissemination of accurate information as to present conditions will be of advantage to the people of the United States and of the Philippine Islands, the Government, in connection with the Manila Merchants' Association, publishes this pamphlet."

The pamphlet has been given wide distribution throughout the United States, and is an unanswerable argument in favor of greater participation in insular enterprise by American capital especially in the production of such tropical supplies as may be successfully cultivated in the Philippines and which America now purchases in foreign lands. On this subject Mr. Pitt writes:

"*In the list comprising nineteen of the more important tropical and sub-tropical commodities imported that last year reached a total value of five hundred and ninety seven million dollars, there are none that the Philippines are not adapted to produce in quantities sufficient to meet the demands of the United States and, too, without having to employhot house methods in their production.*"

What a sum to squander abroad that might make for prosperity in America's insular territory?

Mr. Pitt continues:

"*The Philippines will consume of imported commodities what they are able to pay for. Their purchasing capacity will always be measured by their production of export commodities. There is nothing that they produce or are adapted to produce that the United States is not at present under the necessity of buying from foreign countries whose import trade it does not and never will control. Thus it cannot hope for advantages in other fields yielding tropical products that it already possesses in these islands.*"

The author points to the reciprocal advantages to America and Porto Rico following American activity there in the last decade. In 1901 the internal trade of Porto Rico was $17,950,197 and in 1910 it had reached $68,553,745. In this is represented an increase of $26,000,000 in America's export trade. Of activity of American capital in industries there and returns in trade he says:

"*And the United States is profited by this development as much or more than Porto Rico for not only do American manufacturers and producers gain directly by the increased commerce, but American capital is receiving the cream of the profits of new industries and of old ones extended and enlarged.*"

There is no reason why this experience may not be duplicated in the Philippines.

In concluding his review Mr. Pitt calls attention to the commanding position occupied by Manila as a distributing center for America's Far Eastern trade. He says:

"The proposition of control by the United States of the trade of China through development of the resources and control of the trade of the Philippines, is entirely logical and should appeal to the reason of every practical person.

"As business in these islands increases with the growth of industry, and the people attain a consuming capacity consonant with their capacity to produce, the requirements of this market, which the United States will undoubtedly control, will necessitate the carrying of permanent stocks in Manila which also can be drawn upon to supply the trade of China. United States manufacturers will then have an advantage in the competition for the Chinese trade that cannot be secured by those of other countries for the reason that no European country has a base in the Orient with contiguous territory of any considerable extent whose trade it can be assured of in a measure that will warrant it in carrying stocks to supply. The great ports of China are but a few days' voyage from Manila, and with stocks here upon which to draw, American goods would be made available to merchants of China as readily as they now are to dealers in the United States itself.

"Under the present status of trade in China several months must pass from the time goods are ordered in Europe or America before they are received. Nearly all purchases are made through brokers by Chinese jobbers and distributors, for future delivery and the elements that determine the source of supply are the daily price and rate of exchange. But the long period of time intervening between the date of purchase of goods and their delivery injects into business a very serious element of hazard, besides involving the investment of an unusual amount of capital as compared with the volume of business transacted. Now, the Chinese, although pretty tightly wedded to custom, are, at the same time, keen business men and quick to take advantage of favorable opportunity. It would not be long ere they would come to see the advantage of buying in a market so close as Manila even at a slight increase in original cost for they would realize that the necessity of buying heavily and carrying abnormal stocks can thereby be eliminated; that requirements can be more accurately anticipated and that a tremendous saving can be effected by the great reduction that would result in the amount of capital necessary to conduct their business. I firmly believe that through the agency of the Philippines the United States will come to control the trade of China.

"And China is a big market, with imports already ranging upwards of $300,000,000 annually. And she is destined to grow bigger and more important with each succeeding year, for she is developing rapidly; the building of railroads is giving a strong impetus to industry throughout the empire and a spirit of progress prevails there that is bringing that wonderful country and its people into more intimate relations, commercially as well as politically, with the outside world."

He then covers in detail the products of the Philippine Islands and the opportunities for increasing their production besides providing abundant statistics which in themselves offer a valuable source of reliable information.

This pamphlet is a credit to the author and will certainly serve to counteract in large measure false impressions abroad regarding the archipelago while it is a direct appeal to the intelligence of the American people for greater reciprocity of interest between continental and insular America.

THE FILIPINO AS A LABORER

THE FAR EASTERN REVIEW has secured from Mr. Wickham Quinan, President of the Atlantic, Gulf and Pacific Company of Manila, an authoritative and timely expression on the subject of Filipino labor which we feel certain will serve as a comprehensive presentation of the methods employed in its successful development. His conclusions are significant in view of extensive operations of the Atlantic, Gulf and Pacific Company as contractors of large public works and as proprietors of machine shops in Manila. His experience covers a period of ten years with the result that he has developed an adequate force of efficient labor in all the departments of activity in which his company is interested. President Quinan said:

"Will the Filipino work? Most assuredly. Is he a first class laborer? To answer this question intelligently requires some explanation. I regard the great mass of the laboring element of the islands, from the standpoint of development, as children. They have never had an opportunity to develop qualities inherent in them, which go to make a first class laborer. I say that these qualities are inherent in them, and I speak from ten years' experience in handling native labor. The natives in the city of Manila who have had an opportunity to learn how to use their hands and heads are giving a good account of themselves. There has been a steady improvement in the quality of native labor since we first started to use same, ten years ago, until the present time. At no time since we have been in these islands have we gotten as satisfactory results from native labor as at present, and we attribute this unquestionably to the fact that the natives who are now serving us best on our pile drivers, derricks, in our machine shops, and elsewhere, have been going to school with us, so to speak, for the past ten years. Therefore if you ask me: are Filipinos, speaking collectively, a first class laboring element?, my answer is emphatically, No. But on the other hand, if you refer to that class of native labor which has been brought into contact since American occupation with Occidental methods and under American supervision, has been taught how to do things, then my answer is, most unequivocally, Yes.

"Every individual or corporation engaged in the development of any enterprise in these islands is necessarily dependent upon native labor to accomplish his or its task, and success or failure will depend very largely upon the persons to whose task it falls to supervise the operation of the native labor. If by nature and temperament he is tactful, patient, in other words, a good schoolmaster, using the ruler when necessary, for he is dealing with children, he will succeed. You know, as some one has said, there are more balky drivers than balky horses.

"The laborer in the provinces has not had the advantages of his city cousin. Nature has been very lavish with these islands, and it is not to be expected that the provincial native who has an unlimited credit at a better bank than the Bank of England, i. e. Nature, should be looking for work when he has but to shake a few coconuts from the trees, levy an assessment on the banana trees in the hills back of his casa, or draw fish from the river to supply his needs. Why should he work? You or I under similar conditions would take life as easy as he does. But there are inherent in the provincial native the same qualities that have made the Manila native a first class workman, and as time goes on the horizon of the provincial native will broaden, he too, coming in contact with Occidental methods and ideas, will develop a taste for the better things of life, for the gratification of which he too will be glad to labor, as do the natives of Manila and other places in these islands who have had proper training.

THE BEST CONSTRUCTION OF LOCOMOTIVE FRAMES.

Extracts from a report which was presented to the American Master Mechanics Association by a Committee of leading railroad engineers, June 1911. This report is the result of over a year's investigation covering conditions both in the United States and European countries and may be safely taken to represent the most advanced ideas in regard to locomotive frame construction.

"A more or less vague impression appears to exist in this country that plate frames are freer from breakage than bar frames. Plate frames are more readily repaired than bar construction, with the possible exception of thermit welds, because a plate on one or both sides can be bolted or riveted which will usually reinforce the broken section. On account of their relatively thin sections, plate frames in some instances are also repaired by means of oxy-acetylene blow pipe welds. The general tendency in the design of railway rolling-stock is towards simplicity and the elimination of bolted parts, making or casting pieces together and working away as much as possible from built-up construction. Compared with the bar frame, which is used exclusively in the United States at present, plate frames are essentially a built-up construction, and in the erecting of an engine using such frames the alignment is much more difficult, involving more care and time, so that the erection engine is a longer process than when bar frames are used. This and other causes render plate frame construction undesirable, as a possible substitute for bar frames.

"Furthermore, it is a fact that the one-piece, integral-bar frame construction, when made of suitable material, is as free, if not freer, from defects or breakages than plate frames. From personal observation of a great many locomotives in the principal European countries and from reports obtained from railway men abroad, the fact seems to be that plate frames often break, especially on the older classes of engines, and that unless made exceptionally heavy above the pedestal they may be expected to show partial or complete fractures after a certain period of service.

One English railway reports that the frequency of broken plate frames is almost exactly ten per cent. per year.

It may be interesting to give extracts from an article written by Mr. I. Valenziani, of the Italian State Railways, published in I'Ingegneria Ferroviaria for November 1, 1910, which has a bearing on the subject. He says:

"Many European railways have purchased American locomotives and among the details which were largely appreciated in Europe must be included the bar frames which have two great advantages over the plate frames; namely, the very much greater ease of examination and adjustment of parts lying between the frames, and the greater ease and rapidity with which the various parts can be attached to the frames during the construction of the locomotives.

In Europe bar frames are rather more expensive than plate frames to construct, and no extension of their use is attributable rather to this than to any technical reason.

As an interesting addition to the data contained in this paper, we herewith submit extracts from a report that was made by a representative of a locomotive company, who had been specially detailed to look into the subject of frame failure, but as a committee we do not agree with all of his deductions.

"The number of frame failures which occur in the operation of locomotives in service is the cause of very serious delays......... A comparison of the types of locomotives in service which were built prior to the past three or four years, shows that the bracing of the frames has not been carried out as we now believe to be necessary for good service. In an effort to overcome the number of failures, the sections of frames have been made heavier and splices increased in section and bolting power, but with several exceptions the bracing of frames seems to have received less attention than it deserves. Experience shows that many engines with increased frame sections fail almost as much as they did with lighter frames.

"The first conclusion is that a good design of bracing is more important than heavy frame sections. Another factor is the condition in which the engine is maintained, as shown by several of the detail reports by roads having engines of exactly the same design on different divisions, some of which give little or no trouble, while other divisions report trouble constantly.

"An investigation carried out on one road several years ago proved that the frame at the first pedestal vibrated 1/16 inch both vertically and horizontally, and that in rounding a curve the bottom of the frame was deflected more than the top, which is the natural conclusion when we consider that the frames are usually braced only to the guide yoke and knees at the top rail, and a light wrought-iron brace at the bottom rail. It is this twisting action on the frame which causes so many failures in the front leg of the first pedestal, and in the lower rails of the splice connections in consolidation engines, where the distance from the cylinder saddle to the pedestal is short. It seems to make no difference how heavy the frame rails are made, because if no other changes are made the frame will break just the same."

The committee then submit conclusions and recommendations regarding bar frames, as follows:

"1. That frame breakage is even more general and serious than was first believed, very few roads being free from this trouble. The longer the wheel base of engine, ordinarily, in combination with a roadbed having comparatively short curves, and with frames poorly designed or of inferior metal, or engines not properly kept up, the greater the trouble will be with frames breaking. This latter factor may not be reflected until after the engine has been put in good condition, and then a frame may finally break as a result of the previous poor condition of the engine.

"2. The committee believes that with frames properly designed, if made of a good quality of cast steel, thoroughly annealed, with suitable cross bracing, and engines kept up in reasonably good shape, breakage will practically be overcome.

"3. That a cast-steel, one-piece frame, properly designed, of good material and thoroughly annealed, is better than a wrought-iron frame, because of the difficulty in welding up the large section in a perfectly satisfactory manner, and also because, in casting, bosses, lugs, etc , can be added without the necessity of bolts and studs.

"4. That a bar frame is better than a plate frame, this being the opinion of people who have used both; the plate frame causing about as much trouble with breakage in Europe as bar frames do in this country.

"5. The strap binder appears to be the favorite form of tying frame jaws together, although the cast-steel box binder, with adjustable wedges, has a number of friends, on account of its simplicity and ease with which it can be handled. The toes at base of jaws should be of sufficient depth and size to give plenty of metal to anchor to, whichever binder is used.

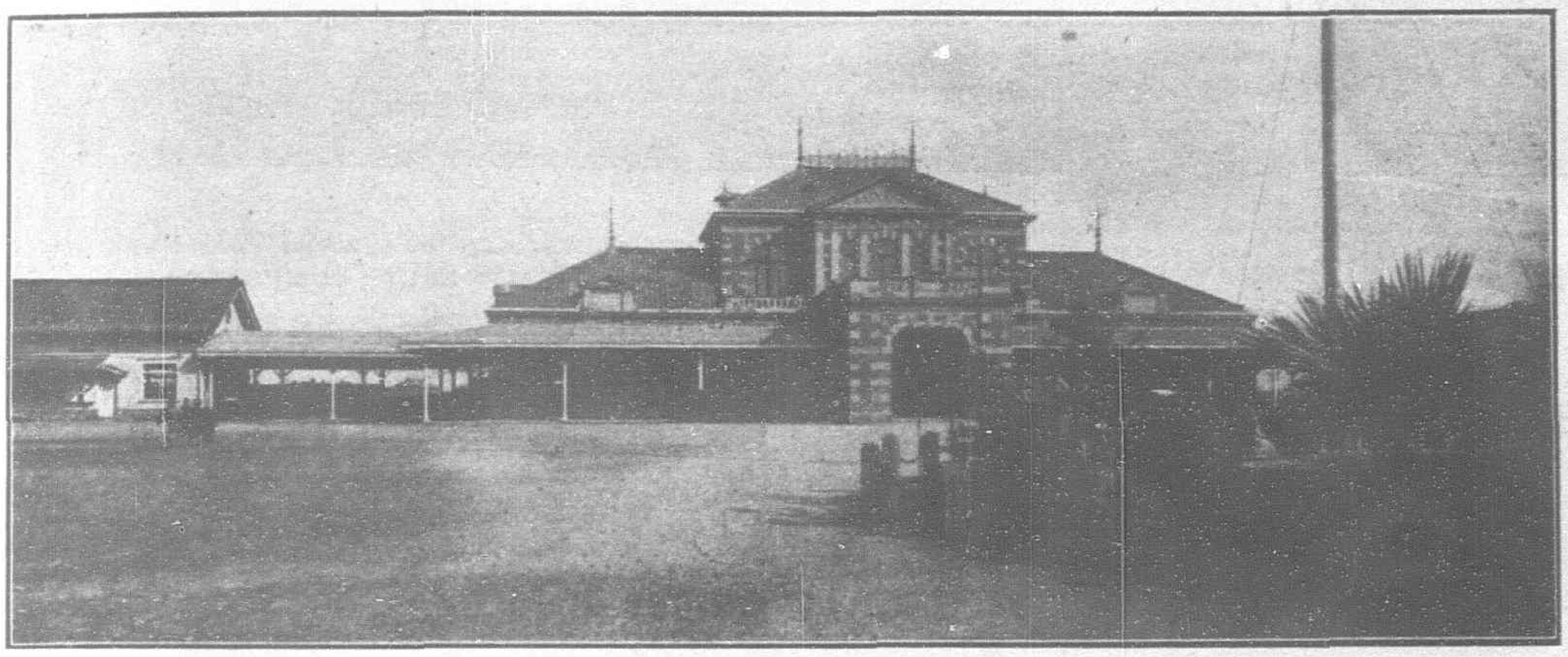
"6. Cases have been reported where frame breakage was directly traceable to expansion of boiler not being properly taken care of by the use of sliding shoes; these shoes, if too tightly fitted or cramped in bolting, or if not lubricated, may prove unsatisfactory. Supporting a boiler by means of vertical plates, if of sufficient strength, provides a satisfactory means of taking care of expansion without imposing undue strains upon the frames.

"7. The committee recommends to steel manufacturers the necessity of making a study of locomotive-frame casting, and its proper annealing, as a number of roads are using wrought iron, but would prefer steel if they could secure reliable castings.

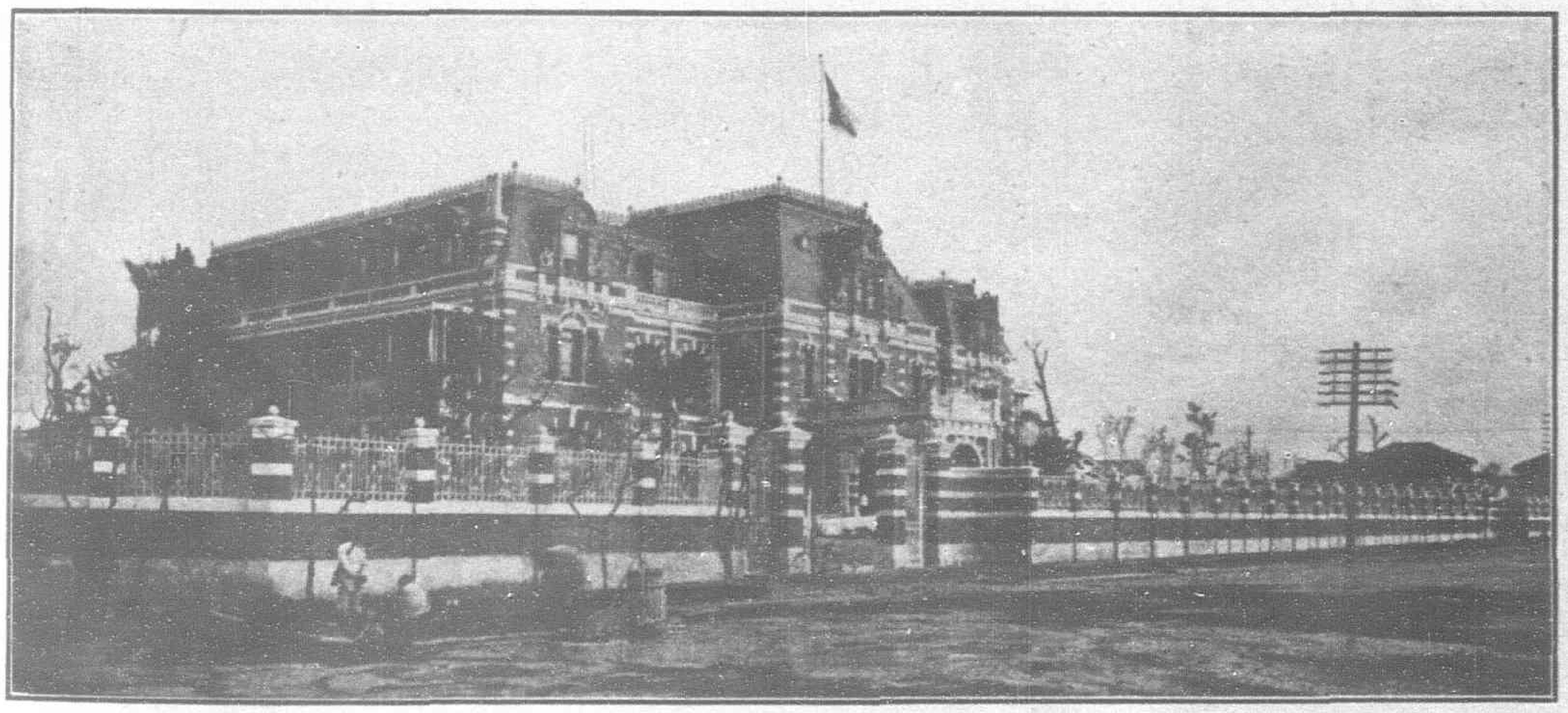
"8. As a general proposition, frame breakage does not ordinarily occur until the engine has been in service two years or more, the older the engine the greater the trouble; they have broken earlier than this, however, on account of flaws, poor welds, or other defects."

(Continued to page 130.)

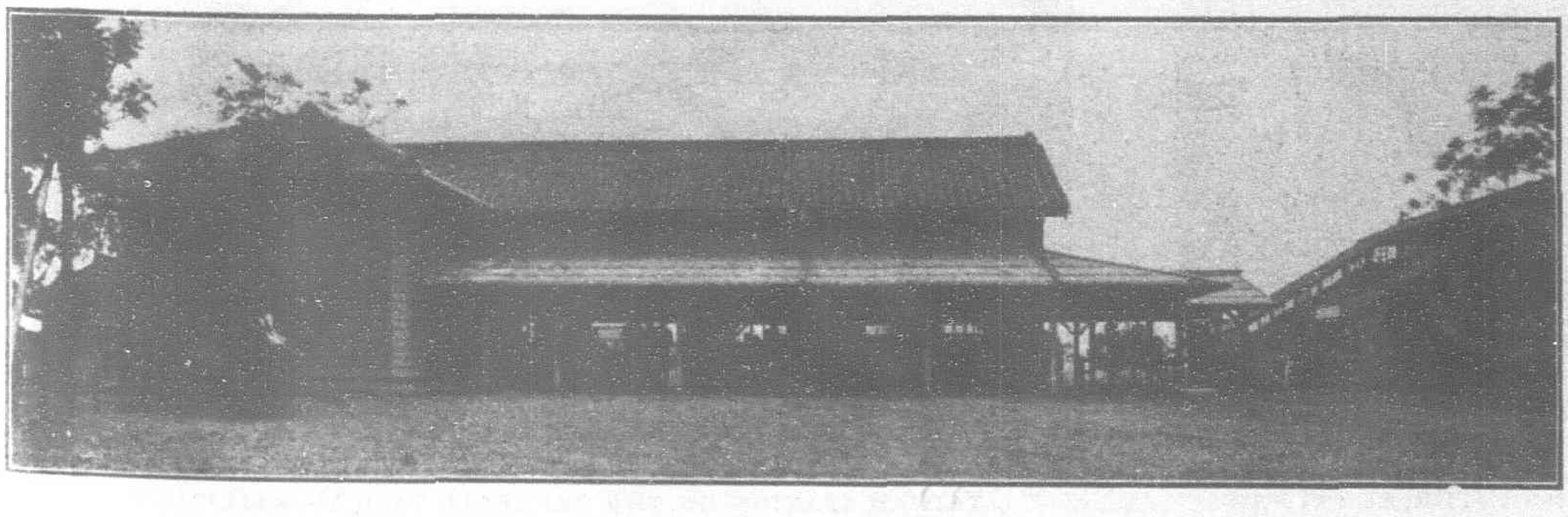
RURUN STATION ON THE IMPERIAL TAIWAN RAILWAYS.



RAILWAY HOTEL AT DAIHOKU IMPERIAL TAIWAN RAILWAYS.



DAIHOKU STATION ON THE IMPERIAL TAIWAN RAILWAYS.



DAICHU STATION LOCATED IN THE CENTER OF FORMOSA, 118 MILES FROM KURUN ON THE IMPERIAL TAIWAN RAILWAYS.

IMPERIAL TAIWAN RAILWAYS

(Continued from page 124.)

porary Railway Bureau. In 1899 the present Formosan Government Railway Department was organized, and the program for the construction of the trans insular line entered into. The estimated expenditure for the new line was Y28,800,000 spread out over a period of ten years. This was included in the general development budget, and the funds raised formed part of the Imperial Japanese Government Taiwan Public Works Loan which was issued for the purpose of carrying out various works necessary for the development of the island and the construction of the railways. This loan, which was to be issued as the funds were required and was not to exceed Y73,500,000, reached at the end of March 1909 the sum of Y34,508,535, of which Y28,800,000 was applied to railway construction and improvements. Of this sum at least Y300,000 were expended in constructing modern railway hotels along the line.

The actual cost of construction was much lower than the estimate, owing to the fall of wages and other favorable conditions and a slight modification of the original route. The main lines and branches comprise 18 tunnels aggregating 4 miles 56 chains, 28 bridges of over 300 feet long, totalling 6 miles 25 chains. Much of the route lay in mountainous country presenting many difficult engineering problems.

The estimate of Y28,800,000 was reduced Y1,250,000, besides the Y300,000 for hotel construction. This gives a rough average cost of Y100,000 ($49,000) per mile for the 271 miles of narrow gauge line.

The program initiated in August 1899 was to have covered a period of ten years, but such satisfactory progress was made that the main trunk line between Shinchiku and Taokow, a distance of 246.8 miles, was completed by April 1908, together with a branch line between Daitoku and Tamsui, 13.7 miles, and another connecting Taokan with Kukiyodo 10.6 miles, a grand total of 271 3 miles.

On October 24th, 1908, the line was officially opened by H. I. H. Prince Kanin amid great enthusiasm.

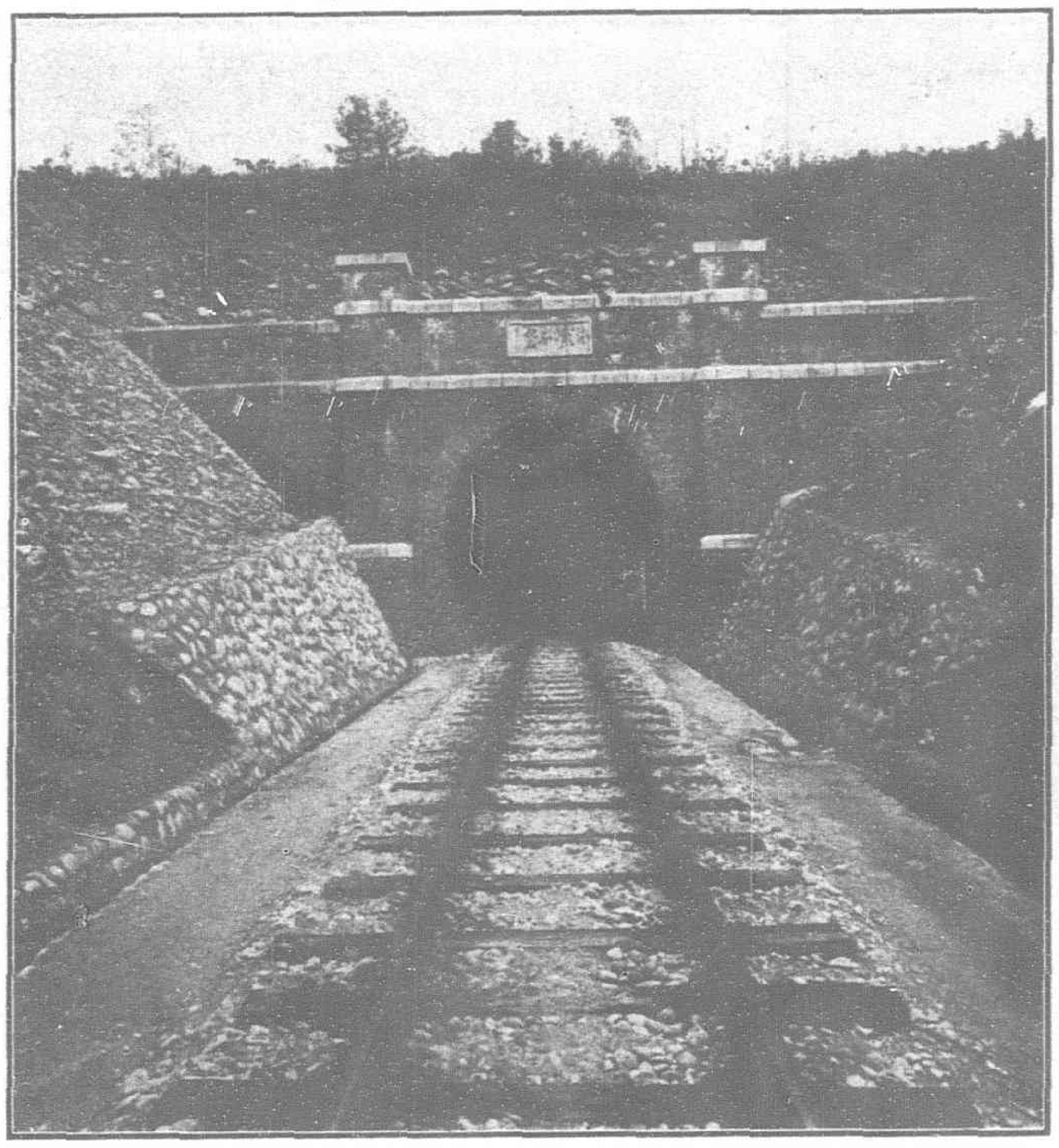
The results for the first year of operation, 1908-09, were most satisfactory and gratifying to the Japanese government who guaranteed the bonds to the extent of $12,901,686 for the roads.

The report showed the general affairs in good condition with a balance of $653,695 (gold) for just a little over a year's operation. Total mileage, 271.3; value of rolling stock, $1,319,670 consisting of 54 engines, of which eight are American made, 112 carriages and 826 wagons. Revenue: Passengers, $615,119; freight, $755,867; miscellaneous receipts $4,424; total revenue, $1,375,410. Expenditures, $721.-715; excess of revenue $653,695. The number of passengers carried during the year was 2,691,034, and the freight carried amounted to 711,930 tons. Persons employed on the line, 2,756; salaries and wages paid during the year, $281,840.

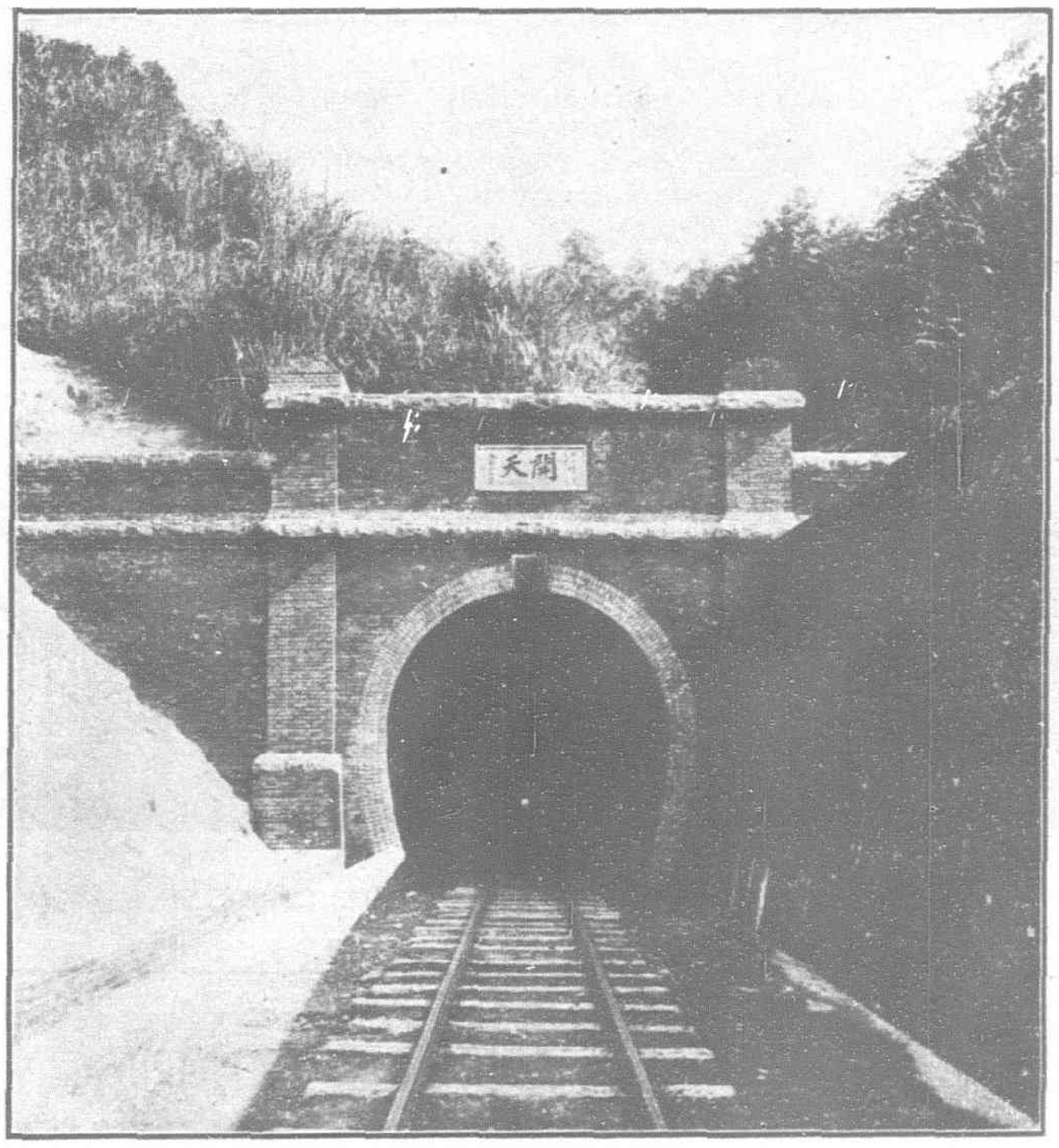
By the end of March 1910, the total revenue amounted to Y3,360,000 and the expenditures to Y1,550,000 leaving a profit of Y1,810.000. The earnings per day per mile averaged Y34.00 against an expenditure of Y15.00. The equipment has been increased to 63 locomotives, 124 passenger coaches and 986 freight cars.

Plans have been made and adopted for the extension of the railway system by two branches, 60 and 41 miles, respectively, in the eastern and southern parts of Formosa.

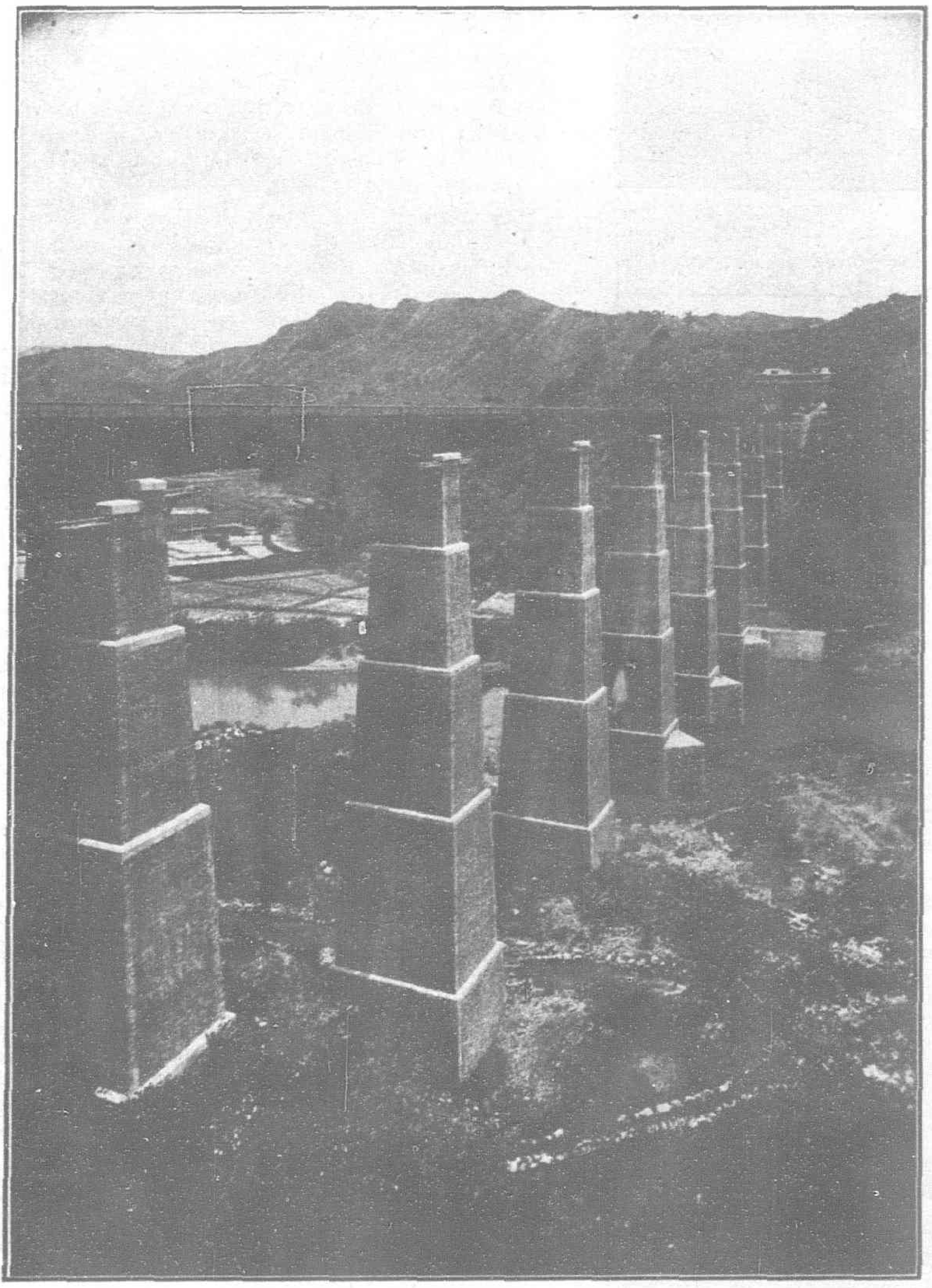
The Taito line, 60 miles in length, will run along the southeastern coast, following the river, and will pass through what is known as savage territory. The road will connect Taito and Karenko, important coast towns, having populations of 4,000 and 2,500 respectively. A public tramway now covers about a third of the distance from Karenko to Taito. The estimated cost of this line is $2,119,986, and the work was started in January, 1910.



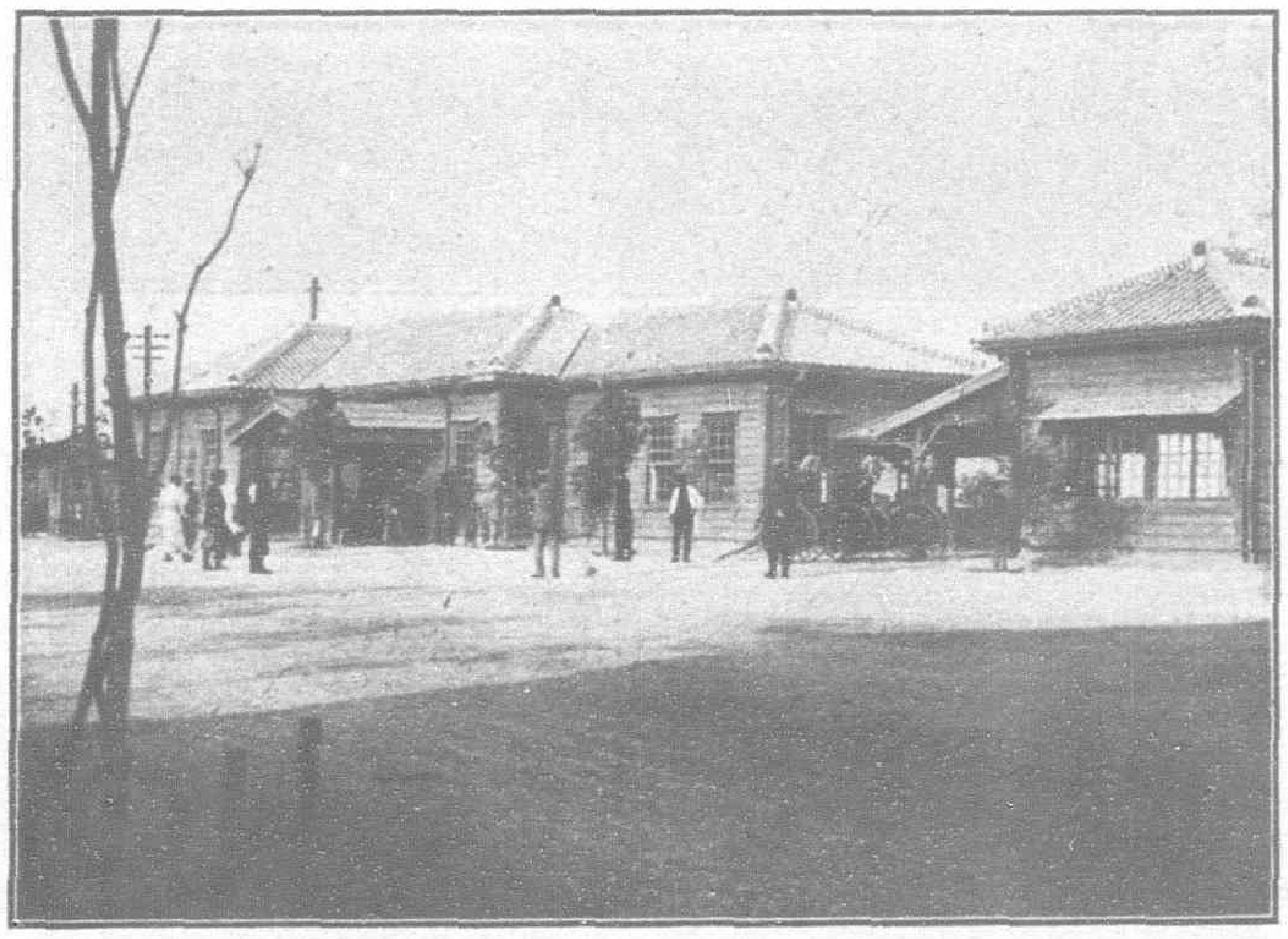
NO. 9 TUNNEL IMPERIAL TAIWAN RAILWAYS—LENGTH 4162 FEET—LOCATED 106 MILES FROM KURUN—COMPLETED, MARCH 1908



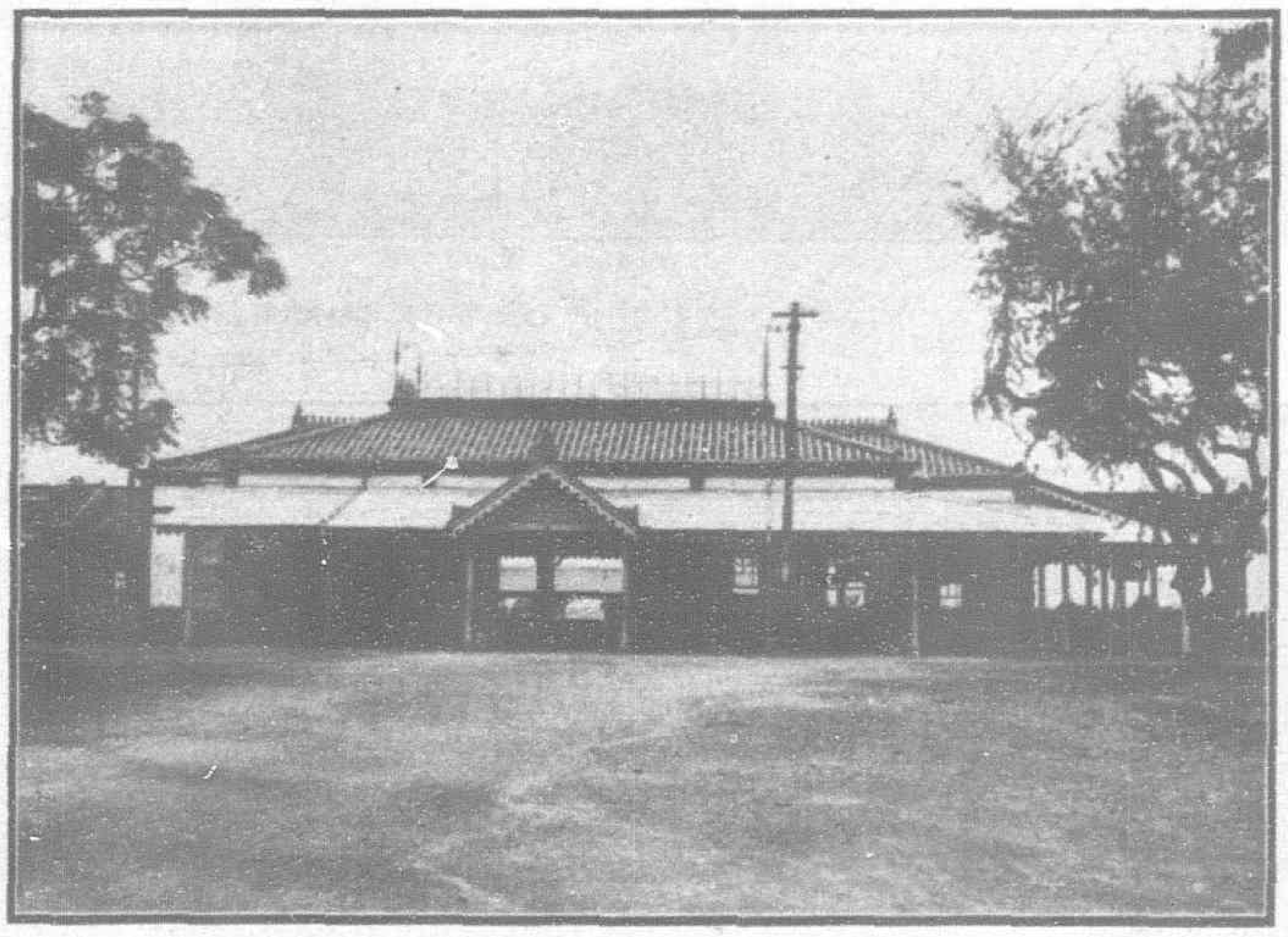
NO. 2 TUNNEL, IMPERIAL TAIWAN RAILWAYS—98 MILES FROM KURUN—LENGTH 2378 FEET—COMPLETED AUGUST, 1907



1st BRIDGE AND TUNNEL AT TALAN KEI ON THE IMPERIAL TAIWAN RAILWAYS, FORMOSA



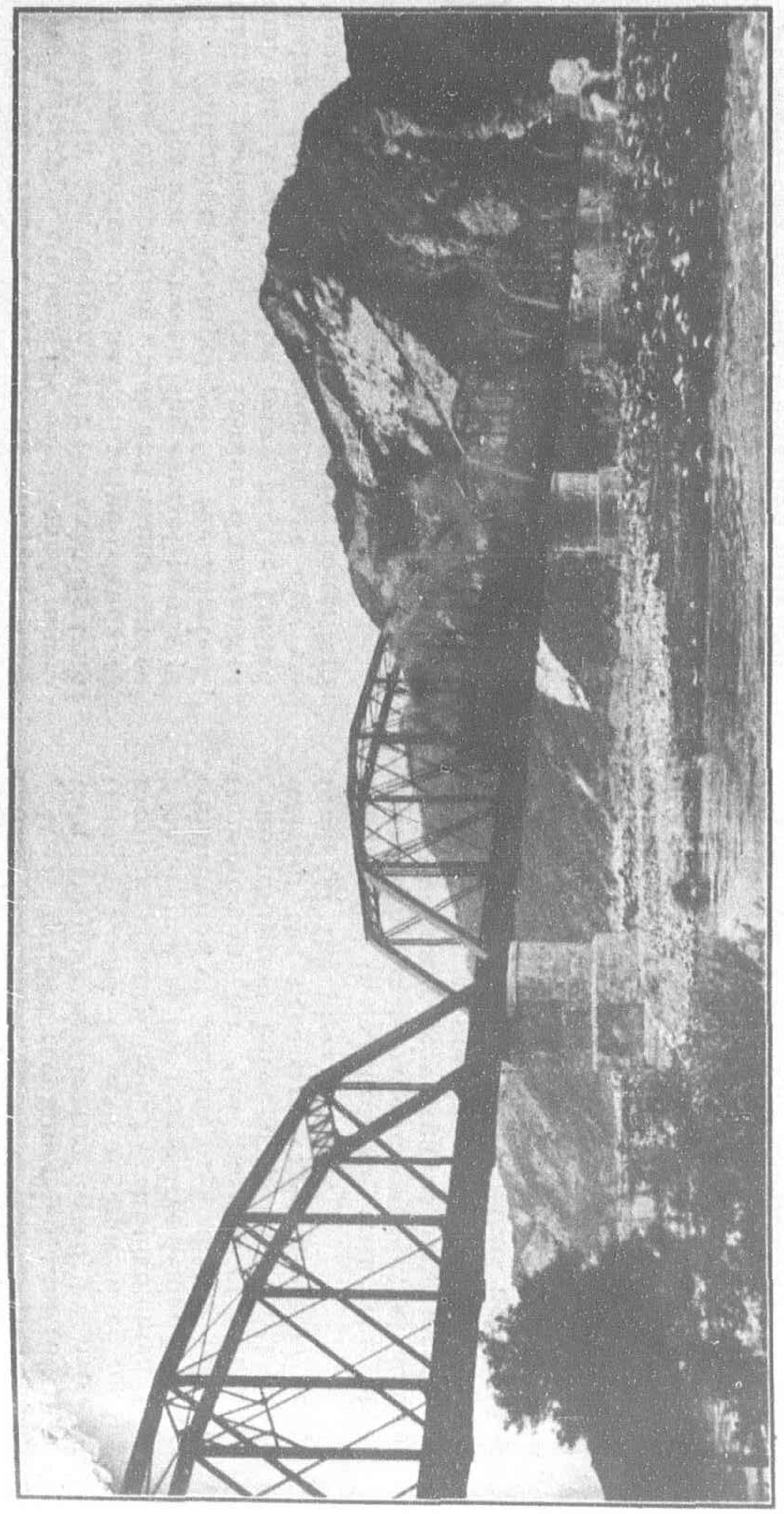
TAKAO STATION ON THE IMPERIAL TAIWAN RAILWAYS



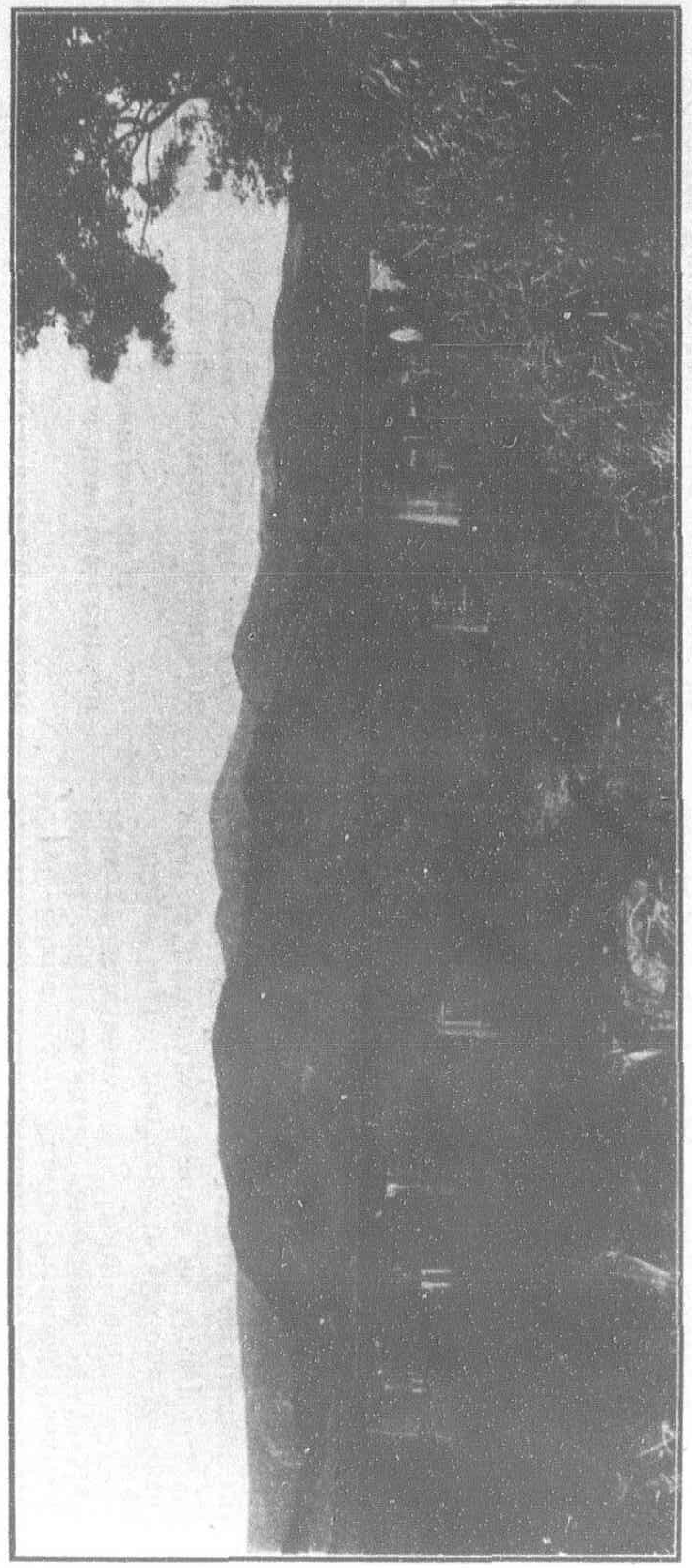
TAINAN STATION ON THE IMPERIAL TAIWAN RAILWAYS

The Arisan Line, 41 miles in length, penetrates into the savage territory. It starts from Kagi, where a bamboo-pulp factory is located and taps the camphor-tree district at Mount Ari. Here are also very valuable forests, and the road is destined to become an important tributary to the main line. The estimated expenditure for the Arisan branch is $1,326,672. Work was to be commenced in April, 1910. The gauge for both lines will be 3.06 feet.

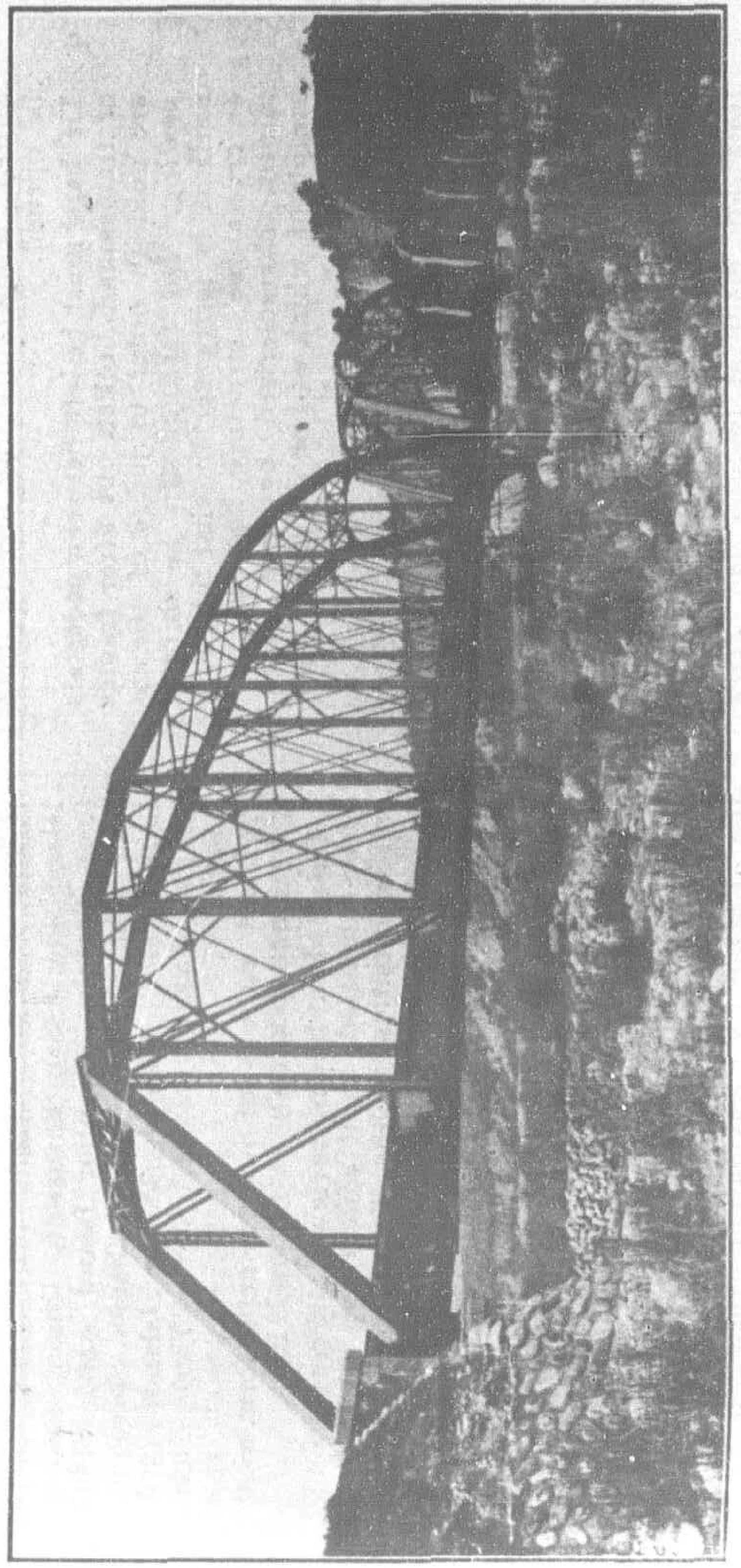
Besides the Imperial Taiwan Railways, Formosa has 298 miles of tramway in operation and 100 miles of tramways under construction. While the tramways are mostly owned by the big sugar companies, there are 45 miles of tramways open to the public and 44 miles of public tramways under construction.



TAI AN KEI BRIDGE SITUATED 102 MILES AND 64 CHAINS FROM KEELUNG, ON THE IMPERIAL TAIWAN RAILWAYS.—LENGTH 1663 FEET OF EIGHT SPANS OF 200 FEET EACH—COMPLETED, FEBRUARY, 1908.



SECOND BRIDGE OVER THE NAISHIWA ON THE IMPERIAL TAIWAN RAILWAYS.



DAIKUSUI RAILWAY BRIDGE, IMPERIAL TAIWAN RAILWAYS.

Some idea of the magnitude of the sugar industry in Formosa may be gathered from the fact that the tramways over which are carried raw materials (sugar cane) comprise 308 miles.

The railway hotel at Daihoku situated directly opposite and convenient to the station is one of the attractions of railway travel. The hotel site proper covers 620 tsubo and including the grounds, 3,000 tsubo. The building is three storey, built of brick and stone, and equipped with every modern convenience. Foreigners traveling through Formosa have found every comfort here at this hostelry. The first floor comprises office, telephone booth, assembly room, tap room, billiard room, smoking and reading rooms, one large and one small dining room, barber shop, lavatories, etc. On the second floor are large and small reception rooms, bedrooms, bath rooms, lavatory, etc. The third floor is divided into bedrooms with baths and a foreign and a Japanese reception room. Outside buildings are provided for recreation, ice plant, engine rooms, servants' quarters, kitchen, stable, etc.

The results for the various working years are as follows:

Year.	Mileage of Open Lines.	Rolling-stock.			Number of Passengers carried.		Quantity of Goods carried.	
		Engine Cars.	Passenger Carriages.	Freight Waggons.	Number.	Fares	Quantity.	Freights.
	M. C.					*Yen*	*Ton*	*Yen*
1900-01	89.04	16	35	164	453,085	239,107	110,173	169,749
1901-02	129.31	19	36	219	792,871	332,578	117,027	183,138
1902-03	154.70	30	45	269	998,467	419,134	234,114	302,917
1903-04	195.40	30	75	310	1,197,644	512,077	315,212	449,507
1904-05	231.16	31	87	426	1,444,715	580,028	349,964	538,870
1905-06	260.24	34	88	449	1.945,567	822,482	433,730	886,930
1906-07	260.24	37	94	495	2,254,731	943,988	508,584	1,066,521
1907-08	271.24	39	99	595	2,489,315	1.055,728	570,509	1,268,302
1908-09	271.24	54	112	826	2,691,034	1,176,696	711,930	1,530,248
1909-10	271.24	59	122	960	3,009,978	1,380.481	853,814	1,907,660

WIRELESS FOR THE PHILIPPINES

The preliminary report of the Philippine Wireless Board appointed by President Taft for the purpose of making "recommendations relating to the construction, operation, maintenance, and management of a system of wireless telegraphy for the Philippine Islands and as to the relations of the Army, the Navy and the commercial community to it" was submitted February 9, 1911, and released for publication last month. The members of the Board were: Honorable Charles B. Elliott, Secretary of Commerce and Police of the Philippine Islands, Lieutenant Colonel George P. Scriven, United States Army, and Commander Chester M. Knepper, United States Navy. The conclusions of the Board embody recommendations not only for a comprehensive system covering the entire archipelago but for the establishment of a system of communications with the neighboring countries and dependencies in the Far East.

The following is a resumé of the recommendations with maps which the Far Eastern Review is in a position to present through the courtesy of the Secretary of Commerce and Police.

"First. That a system of fourteen wireless telegraph stations be established immediately, in conjunction with the existing land lines and cables in the Philippine Islands, as a means of providing quick and uninterrupted communication between the several points of the Philippine Archipelago for the administrative purposes of the Insular Government and the Army and the Navy of the United States; for the transmission of the observations necessary to forecast weather conditions and for the dissemination of these forecasts to the Navy, the merchant marine, and exposed communities; for the requirements of the commercial and business interests of the Philippine Islands in times of peace; and for the strategic and tactical necessities of the Army and Navy in time of riot, insurrection, or war, or the period immediately preceding hostilities.

It is further recommended that the fourteen stations hereinafter listed by name in Groups I and II, and recommended for immediate construction, be supplemented from time to time, as the necessities demand, by the construction of stations of a smaller radius of transmission for the purpose of furnishing communication between points which do not warrant the necessary expenditure of public funds at the present time.

Second. In accordance with the above paragraph, it is recommended that stations of high power, covering as large a radius of transmission as possible, be erected as follows:

(1.) On the Island of Batan, north of Luzon, (2.) At the city of Manila, (3.) At a point near the Straits of San Bernardino, (4.) At the city of Cebu, Cebu Island, (5.) At the city of Zamboanga, Mindanao, (6.) At a point on the southern coast of Mindanao, near Davao.

(These six high-power stations to form what is hereinafter known as Group I.)

The Board further recommends that, in connection with the highpower stations mentioned in Group I, stations of intermediate power, capable of maintaining communication with the nearest high-powered station, be located at—

(1.) Baguio, Benguet, Luzon, (2.) Tacloban, Leyte, (3.) Iloilo, Iloilo, Panay, (4.) Cuyo, Cuyo Island, (5.) Puerto Princesa, Palawan Island, (6.) Dapitan, Mindanao, (7.) Malabang, Mindanao, (8.) Jolo, Jolo.

(These eight intermediate stations to form what is hereinafter known as Group II.)

In addition to the stations mentioned in Groups I and II, this Board recommends that at some time in the future, when necessity demands, low-power stations, capable of maintaining communication with the nearest established station, be installed at the following points:

(1.) Abuyog, Leyte Island, (2.) Alabat, Alabat Island, (3.) Baler, Tayabas Province, Luzon, (4.) Biliran, Biliran Island, (5.) Isabela, Basilan Island, (6.) Burias, Burias Island, (7.) Butuan, Mindanao, (8.) Cagayan, Sulu Island, (9.) Calayan, Calayan Island, (10.) Camiguin Island, (11.) Cape Bojeador, Ilocos Norte, Luzon, (12.) Cotabato, Mindanao, (13.) Culion, Culion Island, (14.) Fort Pikit, Mindanao, (15.) Infanta, Tayabas, Luzon, (16.) Lubang, Lubang Island, (17.) Mangarin, Mindoro Island, (18.) Parang, Mindanao, (19.) Port Banga, Mindanao, (20.) Polillo, Polillo Island, (21.) Siasi, Siasi Island, (22.) San Fernando, Union, Luzon, (23.) Siquijor, Siquijor Island, (24.) Sibuyan, Sibuyan Island, (25.) Bacon, Sorsogon, Luzon, (26.) Tablas, Tablas Island, (27.) Bongao, Tawitawi Island, (28.) Ticao, Ticao Island.

(These stations of low-power to form what is hereinafter known as Group III.)

Third. That having reviewed all correspondence submitted to it concerning the desires and necessities of the Navy in the matter of wireless stations for administrative, strategic, and tactical purposes, and having consulted with various naval officials at present in the Philippine Islands, through the naval representative of the Board; and having considered the opinion of the Commanding General of the Philippines Division upon the necessities of the Army for similar purposes in time of peace and war; and having considered the recommendations of the heads of the Bureau of Navigation, the Bureau of Posts, and the Weather Bureau; and having obtained all possible information concerning

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THE BEST CONSTRUCTION OF LOCOMOTIVE FRAMES

(Continued from page 126)

The following approximate rules will produce sections for bar frames either in wrought iron or cast steel, suitable for modern locomotives:

$$A=\frac{T}{2{,}500 \text{ to } 2{,}700} \quad B=\frac{T}{3{,}000 \text{ to } 3{,}200} \quad C=\frac{T}{4{,}300 \text{ to } 4{,}500}$$

$$D=\frac{T}{1{,}600 \text{ to } 1{,}800}$$

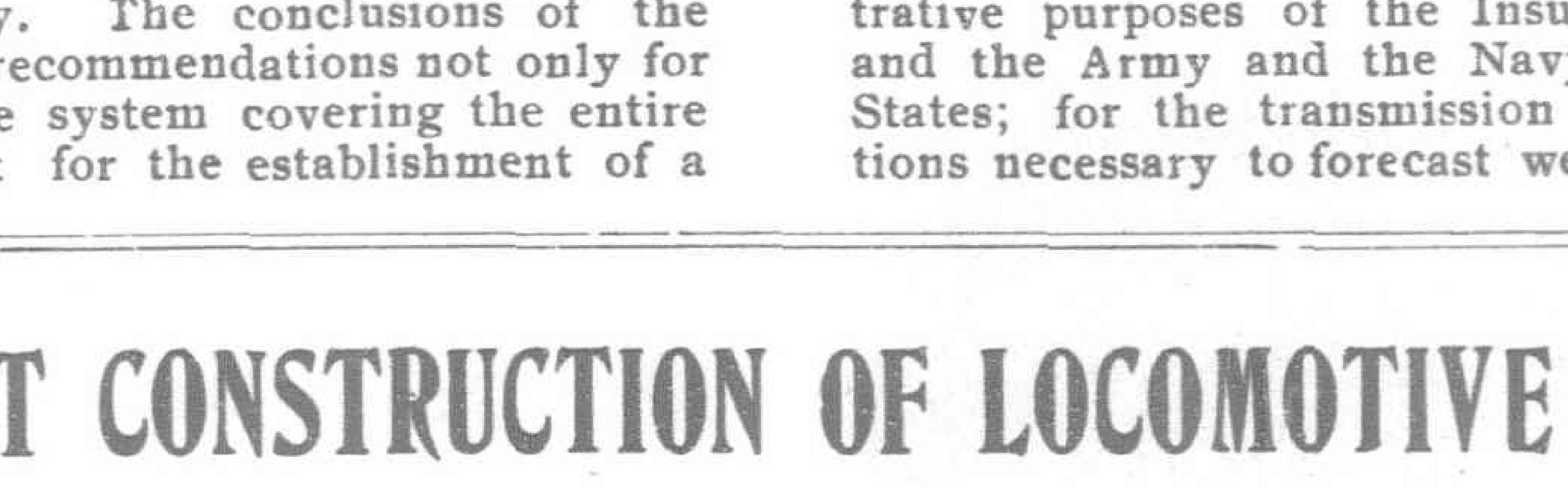
T=Piston thrust (area of cylinder multipled by boiler press.)

A=Square inches of sectional area of frame, top of pedestals.

B=Square inches of sectional area of frame, top rail between pedestals.

C=Square inches of sectional area of frame, lower rail between pedestals.

D=Square inches of sectional area of frame, integral single rail at back of cylinder-keying lug.



The width of frames is usually made in proportion to the weight and power of the engine. Frames of 6 in. are not uncommonly used for very heavy engines.

Most of the important bolts in a frame are vertical. Therefore it is often advisable to increase the width rather than make up the section entirely in depth, because the section is not cut away so much when large bolts are used, and for that reason, where 1-⅜ or 1-½ in. bolts are used, frames of greater width can be more economically employed than the narrower sections."

The following is the specification to which some of the larger railroads buy their cast steel frames:

MATERIAL:

1. Open hearth or crucible steel.

CHEMICAL:

2. Phosphorus not to exceed 0.05 per cent.
   Sulphur ,, ,, ,, 0.05 per cent.

PHYSICAL:

3. Tensile strength per square inch, not less than 60,000
   Elastic limit per square inch, not less than 27,000
   Elongation in 2 inch., not less than 22%
   Reduction in area, not less than 30%

TEST PIECES:

4. Test pieces 10 in. long, 1 in. wide and 1-¼ in. thick, giving 1 in. square when removed, must be cast on each frame.
5. Test pieces must be left attached to castings, but so nearly cut through that they can be easily detached with hammer and chisel.

STAMPING AND MARKING:

6. Each casting must have melt number plainly stamped with ¾ in. figures or larger, manufacturer's trade mark and pattern number stamped or cast on, and order number plainly marked with white lead.
7. Each test piece must have melt number and order number stamped on it.

ANNEALING:

8. Castings must be heated uniformly to about 850 degrees Centigrade, or 1560 degrees Fahrenheit. The heat must be applied slowly enough so that castings in all parts of the furnace are approximately the same temperature. As soon as the castings have reached the required temperature the furnace may be opened.
9. Tie bars must be left between pedestals of frames and broken out after frames are cold in order to judge of the annealing. No castings can be shipped until it is fairly certain that the proper crystalline structure has been obtained, characterized by fine grain, sample of which will be furnished upon request.

FINISH:

10. Castings must be true to pattern, and free from slag, blowholes, shrinkage-cracks, and sand. Bearing surfaces must be solid, and no porosity will be allowed in positions where the resistance and value of the casting for the purpose intended will be seriously affected.
11. Defective castings will be returned at the expense of the manufacturer. Where tests are made at foundry no extra charge will be allowed for such tests as are required.

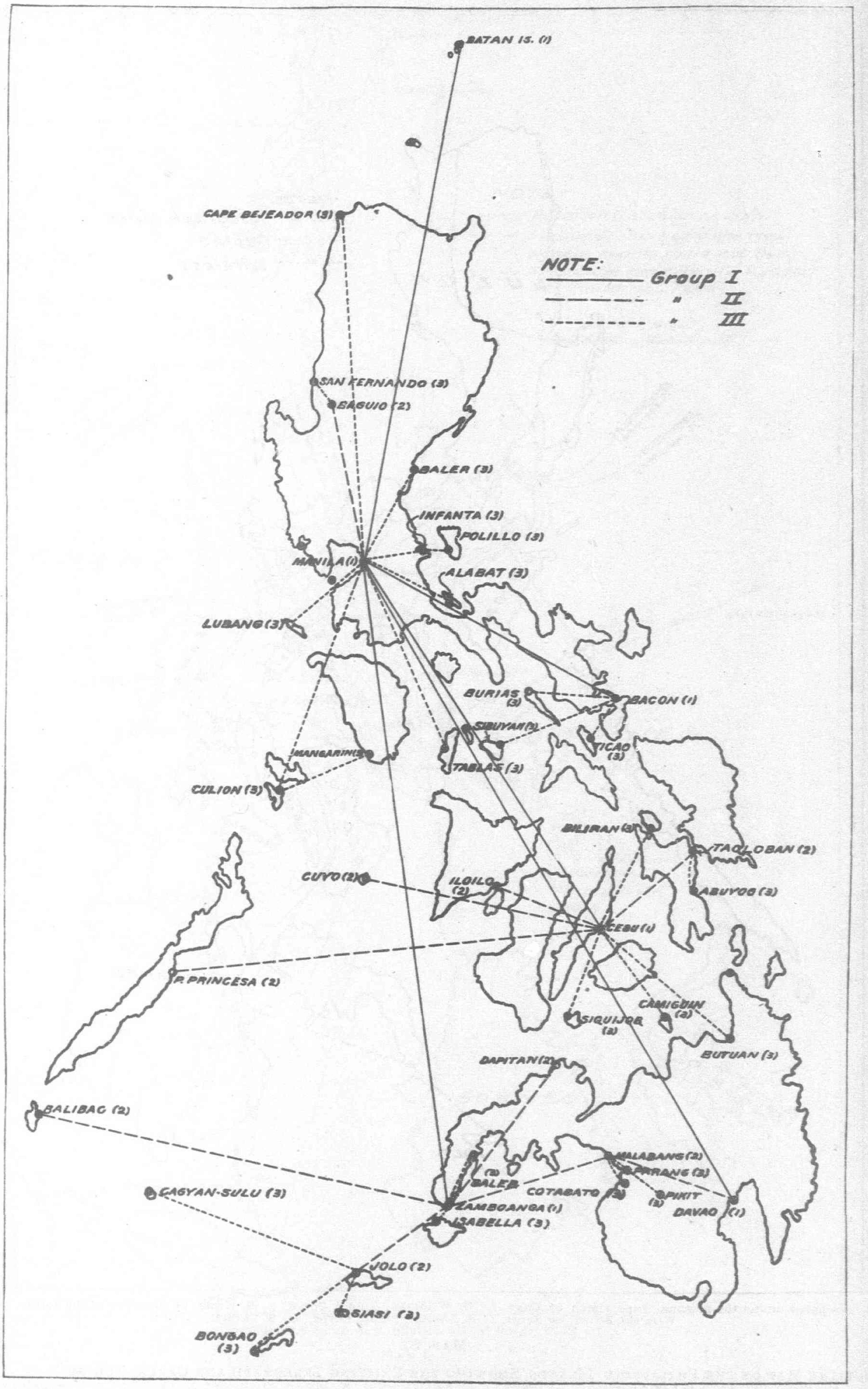
the necessities and desires of the private shipping and commercial interests—this Board recommends that the Navy Department be permitted to construct and operate stations at Cavite and Olongapo, at its own expense, for the free and unrestricted use of that Department; and that the War Department be permitted to construct and operate such stations as may be installed at the expense of the War Department on military reservations, in the vicinity of Manila and Subic Bays, or elsewhere on the order of the President, for the free and unrestricted use of that Department; and, exclusive of these stations, that the cost of erection of the stations recommended in Groups I, II, and III be apportioned as follows: Thirty per cent of the cost as representing the interests of the Army, 25 per cent of the cost as representing the interests of the Navy, and 45 per cent of the cost as representing the interests of the Insular Government, in time of peace, war, insurrection, or riot. The 45 per cent apportioned to the Insular Government represents the interests of the several Bureaus of that Government, as well as the commercial, private, and coastwise shipping interests in the Philippine Islands.

Fourth. From careful estimates of the cost of wireless material, the expenses of the erection of the necessary antennæ and supports, the construction of the stations, and the necessary labor and superintendence of erection, the Board is of the opinion that the sum of $300,000 will be necessary for the purchase, erection, and installation of the necessary apparatus at the fourteen stations recommended for immediate construction, marked "Group I" and "Group II" on Map A, facing page 8. The Board further recommends that the Congress of the United States be requested to appropriate, on account of the interests of its Army and Navy in the wireless telegraph system of the Philippine Islands, the sum of $165,000, and that the Insular Government of the Philippine Islands be requested to appropriate the sum of $135,000 (the remainder of the sum necessary for the construction of these stations), provided that, when any station in Group III is erected, the cost of erection be borne by the United States and Insular Government in the same proportion as those stations listed in Groups I and II, and that when the necessity arises for a station or stations to be added to the system other than those designated in Groups I, II, and III, they shall be erected by the Insular Government, subject to the approval of the Secretary of War and the Secretary of the Navy, in the same manner as recommended for the erection of the stations in Groups I, II, and III.

Fifth. The Board recommends that on account of the fortification of Manila Bay, the naval stations of Cavite and Olongapo, and the constant presence of naval vessels in the adjacent waters, all wireless stations erected in connection with the defenses of Manila Bay and the naval bases adjacent thereto at the cost of either the War or Navy departments, and maintained exclusively by those Departments, shall be considered as a separate group of stations, to be governed and regulated as to tolls in the express manner hereinafter mentioned in paragraph (*a*) of this section, and that all other stations erected as a part of the wireless telegraph system of the Philippine Islands, at the joint cost of the Insular Government, the Army, and the Navy, known as Groups I, II, and III, which form a part of the system of information throughout the Philippine Islands in combination with the cable system, shall be maintained by and be under the exclusive control of the Insular Government in time of peace, in the manner set forth in the following paragraphs marked (*a*), (*b*), (*c*), and (*d*):

(*a*) All messages, whether public or private, received for transmission at any wireless station shall be paid for at a rate and in a manner to be fixed by the Bureau of Posts, with the following noted exceptions:

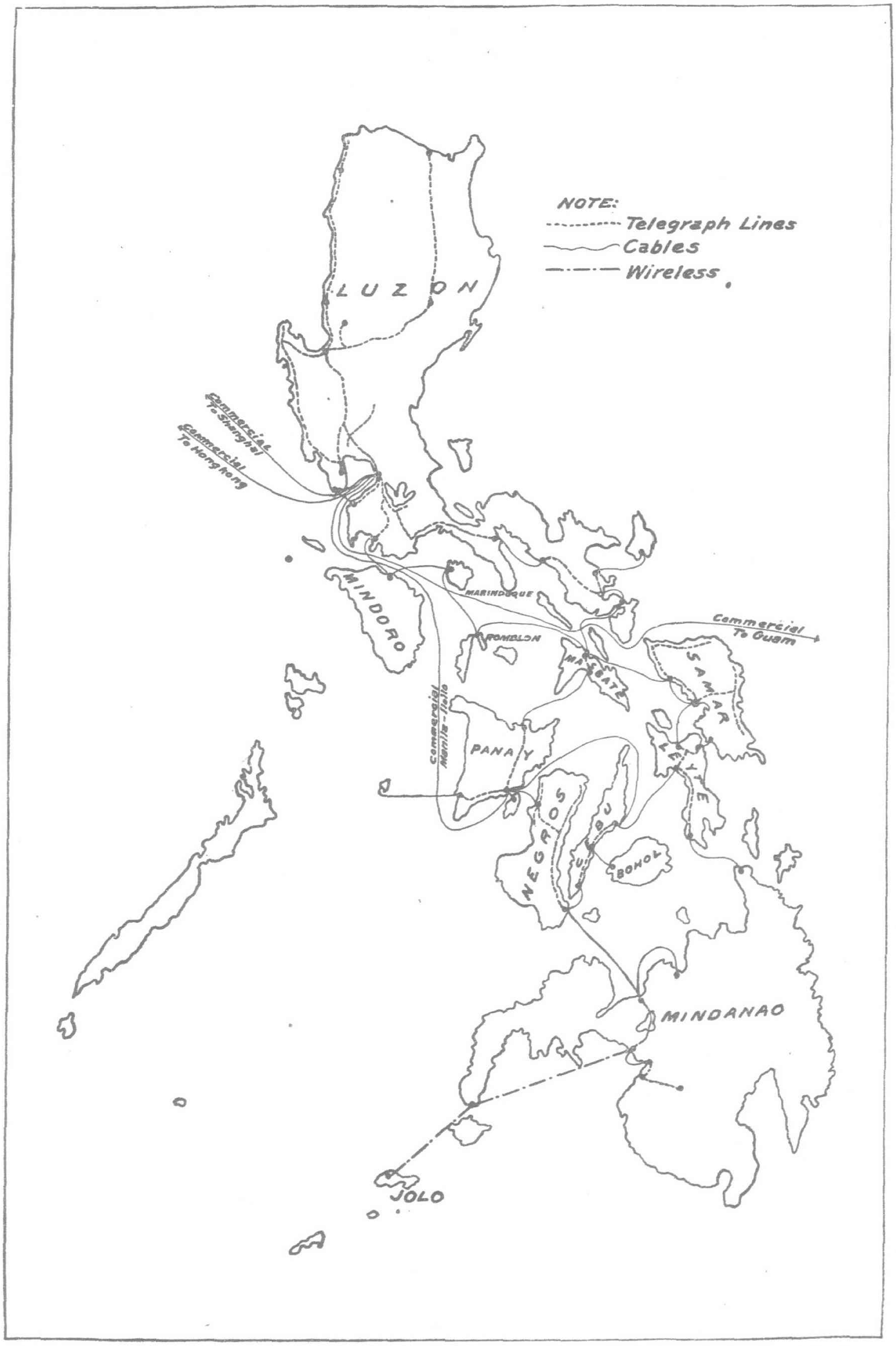
The tolls for purely official messages originating at and destined for the stations maintained and operated by the War and



[Prepared under the personal supervision of Capt. L. D. Wildman, Signal Corps, U. S. Army, by direction of the Join Wireless Board, by Sergt. J. R. Shettel, Signal Corps. U. S. Army.]

MAP A.

OUTLINE MAP OF THE PHILIPPINE ISLANDS, SHOWING THE STATIONS ENUMERATED IN GROUPS I, II, AND III.



(Prepared under the personal supervision of Capt. L. D. Wildman, Signal Corps, U. S. Army, by direction of the Joint Wireless Board, by Sergt. J. R. Shettel, Signal Corps, U. S. Army.)

MAP B.

OUTLINE MAP OF THE PHILIPPINE ISLANDS, SHOWING THE EXISTING TELEGRAPH AND CABLE ROUTES

Navy Departments, and the vessels equipped with wireless telegraph owned or operated by those Departments, shall be regulated exclusively by the proper military and naval authorities, provided that these Army and Navy stations shall accept for delivery all proper messages, public or private, and shall transmit, to designated stations of the system, messages tendered by any wireless station in the Philippine Islands, or transmitted by wireless apparatus installed on domestic or foreign vessels with which written arrangements concerning these regulations have been made by the Bureau of Posts.

(*b*) That the amount of the tolls collected on behalf of each station in the system shall be credited to the "Wireless Maintenance Fund" of the Philippine Islands, from which fund shall be paid all expenses for the operation and maintenance of the stations of the wireless system, except those stations operated and maintained by the Army and Navy Departments for the defenses of Manila Bay.

(*c*) That at the end of each fiscal year a balance shall be struck between the cost of maintenance and operation and the amount of the tolls received, and that all profits shall be deposited in the Treasury of the Philippine Islands in the manner now provided by the regulations governing the funds of the Bureau of Posts.

(*d*) That if at the end of the fiscal year there shall be a deficit the Bureau of Posts shall be reimbursed, by appropriation or otherwise, from the Insular Government and from the Government of the United States in the proportion of 45 and 55 per cent, respectively.

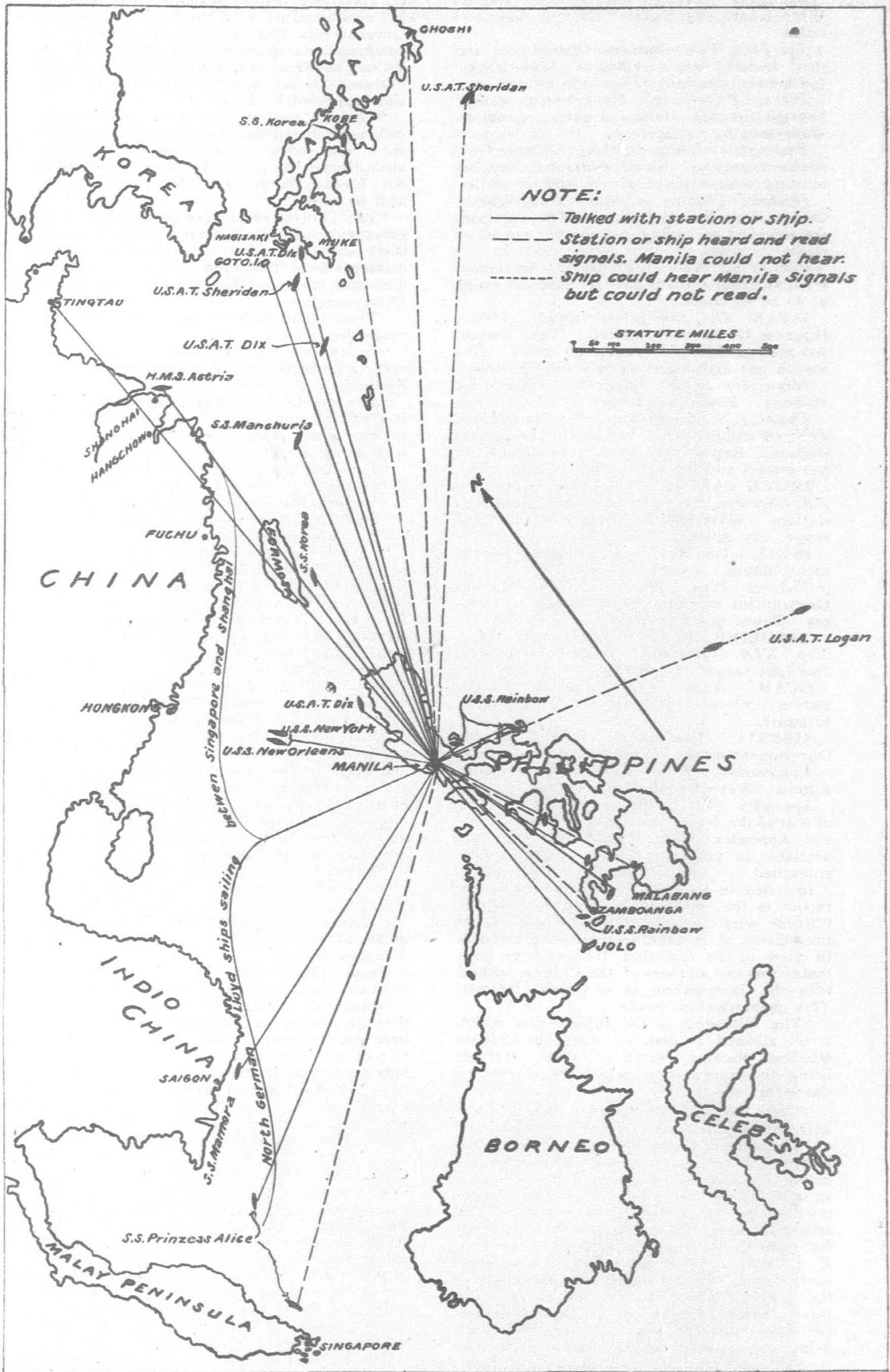
Sixth. That, with the exception of the stations heretofore mentioned, to be erected and operated by the Army and Navy for the defenses of Manila Bay, all purchases of instruments, apparatus, material, and devices for the wireless telegraph system of the Philippine Islands, the preparation of the plans for all structures in connection therewith, the erection of the necessary buildings, and the installation of the machinery shall be under the direction of the Secretary of Commerce and Police of the Philippine Islands, provided that such purchases, whenever possible, shall be based upon actual results obtained by experiments with similar wireless instruments, apparatus, or devices, tested in the Philippine Islands; and provided further, that the apparatus when installed shall be capable of emitting any wave length between a minimum length of 400 meters and a maximum length of 5.000 meters, and that the waves so emitted shall be damped by not more than 10 per cent.

Seventh. That no authority or franchise be granted for the erection or operation of any wireless station on land within the boundaries of the Philippine Islands, other than those stations erected and operated by the War and Navy Departments as heretofore specified, and those stations recommended in Groups I, II, and III, unless approved by the Secretary of Commerce and Police, and that no commercial vessel of American registry in the Philippine Islands shall be permitted to operate any wireless telegraph apparatus emanating a wave or waves within 10 per cent of the wave length habitually used by the wireless telegraph stations of the Philippine system.

The Board further recommends that the Secretary of Commerce and Police be given the necessary power to inspect the wireless apparatus installed on commercial vessels of American registry operating in the Philippine Islands and to issue such rules and regulations as will prevent interference with stations operated by the Insular Government, and that this power be extended to include the regulation of vessels of foreign registry fitted with wireless apparatus when within the waters under the jurisdiction of the Insular Government, and that suitable penalties be prescribed for infraction of the promulgated regulations.

Eighth. That whenever there exists insurrection, riot, rebellion, or threatened trouble to the peace of the Philippine Islands, all the means of communication within the Philippine Islands shall be placed under the control of the Commanding General of the Division, upon authority of the Secretary of War, except those stations erected by the Navy which shall at such times continue under control of the senior officer of the Navy present in Philippine waters."

Appendix A, attached thereto contains a letter written by Colonel George P. Scriven,



[Prepared by Sergt. J. R. Shettel, Signal Corps, U. S. A.]

MAP C.

TRANSMISSION RESULTS OBTAINED FROM A 4.6-KILOWATT (PRIMARY ENERGY) WIRELESS TELEGRAPH STATION (TELEFUNKEN SYSTEM) ERECTED BY GERMANN & CO. AT MANILA, P. I. OPERATED UNDER THE DIRECTION OF CAPT. L. D. WILDMAN, SIGNAL CORPS, U. S. ARMY, FOR THE INFORMATION OF THE JOINT WIRELESS BOARD.

Chief Signal Officer, Philippine Islands, under date of March 11, 1910, to the Division Commander reviewing the wireless situation and needs of the service and recommending the co-ordination of the Army, Navy and Insular Government and the appointment of an Advisory Board representing the different interests to make recommendations to Washington. It was this letter that finally resulted in its appointment by President Taft on April 30, 1910. The last paragraph of Colonel Scriven reads:

"In conclusion, I beg to say that the only excuse for the somewhat extended exposition of the matter here submitted lies in the importance of the subject to the three interests involved. The vast field of wireless telegraphy in the Philippine Islands is still open, but can not much longer remain so, and the danger that the United States and the Insular Governments may lose possession of the field and be forced to oust a parcel of squatter claimants is, I think, threatening, unless immediate steps to prevent are taken. Furthermore, it is probable that both Governments and that each military service will, if allowed to work out its own plan without co-ordination, establish three conflicting systems, that must end in increased cost and ultimate confusion to all, and it is this fact that warrants the attempt to draw in the strongest manner possible the attention of proper authority to the extreme importance of taking at this time such preliminary steps toward securing immediate and concerted action as shall be necessary to organize an economical, coördinate, and efficient system of wireless that shall answer the requirements of the civil and military conditions existing in the Philippine Islands."

At the present time the length of cables in the Philippines aggregates 1,483 miles mostly installed by the U. S. military and entailing large expense in up-keep. It is estimated that an expenditure of $1,000,000 would be involved to repair the present system and an annual expense of $1,000,000 for maintenance due to the numerous landings over coral reefs exposed to the battering action of strong tides in shallow water. The extensive land wires involved serious expense for maintenance due to damage by storms, insects and the encroachments of rapid vegetable growth through many miles of wooded areas. The maintenance of the main cable lines connecting Manila and Mindanao is recommended for the reason that the volume of business north and south demands a greater capacity than could be handled by wireless stations at the present state of the art with regard to delays caused by atmospheric and static disturbances. The maintenance of the main cable as well as the wireles would provide against delay from these causes in time of peace. The destruction of cables in time of war or insurrection, jeopardizing effective mobilization of troops would make the installation of wireless stations seem imperative.

A further consideration besides the military and civil functions referred to the Board emphasized the desirability of wireless for use of the weather bureau to obtain information from points far beyond the waters of the Philippines—Guam on the east, Yap to the south east and numerous stations on the Chinese and Japanese coasts to the north. Such a system as proposed would make instantaneously available knowledge of local weather conditions in all the various areas referred to including reports from ships at sea, as well as intensity and direction of destructive typhoons.

The conclusions of the board as to the location of the different stations were arrived at after consultations with the chief signal officer of the Philippine Division, the Chief of the Weather Bureau, the Chief of the Bureau of Navigation, the Chief of the Bureau of Posts and representatives of the various commercial, shipping and business interests, the details of which are included in appendix "B".

Among other information included is that contained in a memorandum of wireless stations within range of Manila concerning which the board has actual information as follows:

CHINA: *Hongkong* (*Cape d'Aguilar*), *HK.*—Small British admiralty station. For the exclusive use of the admiralty in communication with His Majesty's ships close in.

Tsingtau, KTS.—German naval station. Wave length, 350 meters; daylight range, 130 miles. This station has exchanged signals with Manila.

Shanghai, *SNG*.—Commercial station. Wave length, 300 meters; daylight range, 70 miles.

Tai Lien Wan.—Japanese Government station. Located near Port Arthur. Wave length, 350 meters; daylight range, 170 miles.

Pekin, *PK*.—Italian Government station. Located in the Italian legation grounds. Wave length, 300 meters..

Pastingfu; Tientsin; Pekin.—Chinese Government stations. Small stations thoroughly military with a range of not over 40 miles.

Hoihow; Chuwen; Canton; Kongmoon.—Chinese Government stations. These stations are reported as having a daylight range of about 70 miles.

FORMOSA: *Kelung*.—Japanese Government stations. Believed to have a daylight range of 60 or 70 miles.

JAPAN: *Osi Saki* (*Gota Island*), *JOS*.—Japanese Government station. Wave length, 300 meters; daylight range, 130 miles. This station has exchanged signals with Manila.

Nagasaki; Sasebo.—Japanese Government stations. Power not known.

Choshi, *JCS; Shiomizaki*, *JMS; Tsunoshima*, *JTS; Ot chishi*, *JOI*.—Japanese Government stations. Reported to have wave length of 300 meters and daylight range of 130 miles.

DUTCH EAST INDIES (JAVA): *Batavia*, *BA; Cheribon*, *CB*.—Netherlands Government stations. Wave length, 600 meters; daylight range, 125 miles.

INDIA: *Bombay*, *BYR*.—Indian Government station. Range, 300 miles.

Victoria Point; Diamond Point.—Indian Government stations. Wave length, 600 meters. Power not known.

CAROLINE, ISLANDS: *Angauar*, *KAN; Yap*, *KJA*.—German Government stations. Daylight range, 185 miles.

GUAM: *Guam*, *NPN*.--United States naval station. Wave length, 425 meters; power, 3 kilowatt.

SIBERIA: *Vladivostok*, *BWT*.—Russian Government station. Wave length, 360 meters.

Vladivostok, *MW*.—Russian Government station. Wave length, 1,200 meters.

Appendix "C" is devoted to the division of cost of the federal and insular governments and Appendix "D" contains all the data available in preparing the estimates of cost submitted.

Included in appendix "I" attached to the report is the following description of the Chinese wireless stations furnished by one of the officers of the Italian legation guard and in view of the fact that Italians have been instructors and advisers of the Chinese authorities the information is of special interest. This memorandum reads:

"The following is the information which I am allowed to give you about the Chinese wireless stations, some of their features being the same as ours, which are of reserved character.

"There are in Chili Province three Chinese Marconi stations, viz, one at Paotingfu, one at Tientsin, and one at Peking (in the Nanhaitzu). These stations form an approximately equilateral triangle. The first one is situated among the numerous barrack buildings, close to the military hospital. The second is near the public gardens and not far from the av nue leading to Tientsin City R. S. station. The third lies 10 kilometers south from Peking among the barracks of the Sixth Division in the Nanhaitzu. The three stations are under the direct charge of two officers of the board of war—their rank being respectively colonel and captain.

"The noncommissioned men, two telegraphists and an interpreter for each station, depend from (are under direct supervision and instruction of) an inspector, English speaking, whose teacher in electricity was a corporal in our semaphore corps, now in Italy.

"He inspects them with the utmost rigor and minuteness, but the condition of the material is no longer such as it was when first installed and cared for by Lieutenant Grassi, R. I. N., three years ago.

"The Marconi wireless company having refused to sell to the Chinese their detectors (?), probably being prevented from doing so by arrangements with the British and Italian Governments, this inspector has succeeded in building them up according to the descriptions he may have read in scientific books and papers, but such are far from the efficiency of reception possessed by ours.

"The Chinese stations are a thoroughly military concern and do not accept telegrams from the public on civil business, but some absurdly private service is being carried on in the English language. Official messages are sent in cipher."

"The Chinese employees do not give us an exact account of the distance now reached by their apparatus. But it is stated that their messages from Paotingfu do not get as far as Tientsin, nor those from Tientsin to a ship at Chingwangtao.

"Time table: 8 o'clock and 18 o'clock correspondence hours.

"Every two hours news is exchanged concerning weather conditions and atmospheric discharges.

"The station at Paotingfu appears to be the less efficient one. Especially in summer time, it very often goes days at a time without wiring or answering.

"The men are clever and intelligent and if the material is not kept up so carefully as by Europeans, it can be ascribed to that lack of continuous effort and logicity (?) that is so peculiar to Chinese mentality and character.

"As for the stations on board ship, I can only tell you that Lieutenant Monroy before leaving (in 1906, winter) inspected them and restored them to their previous efficiency. He found that distances differed according to ships, although the materials given to them were all alike. Now they are thought to be all right, as they ask for our help as a rule when in distress. Admiral C. P. Sah takes the utmost interest in the stations of his fleet.

"It is stated that the Germans have started a school of wireless (Telefunken) and have applied for permission to erect two stations and masts in Canton and Kowloon.

"It is also stated that there is a branch of the Telefunken Company in Shanghai; Arnhold, Karberg and Co. have for some months past been engaged or concerned in the wireless business.

"There is some talk of erecting some wiretess stations in Mongolia to connect it up with Pekin.

"It is also stated that Tuan Fang (viceroy at Shanghai) will erect some stations in the Yangtsze Valley.

From other sources than the above it is known that Tuan Fang approached the Italian Government, or rather the Marconi Company through the Italian Government representative here, with reference to the purchase and erection of certain stations in the Yangtsze Valley. It is understood that the deal failed because of price, but more because the Marconi Company would not sell certain parts outright, being prevented from doing so, it is said, by their contract with the British Government.

In connection with the location of the Chinese wireless stations at Paotingfu, Tientsin, and Peking, it should be kept in mind that the Italian Government has a station here in the Italian legation grounds in Peking; that it is the same system that the Chinese are using; that by means of it they are enabled at all times to know when the Chinese stations are working and of course to know a good deal about the character and condition of such stations, especially their rate and ability to dispatch telegrams, etc.

The Italians say that they have no difficulty in communicating with warships lying off Chingwangtao.

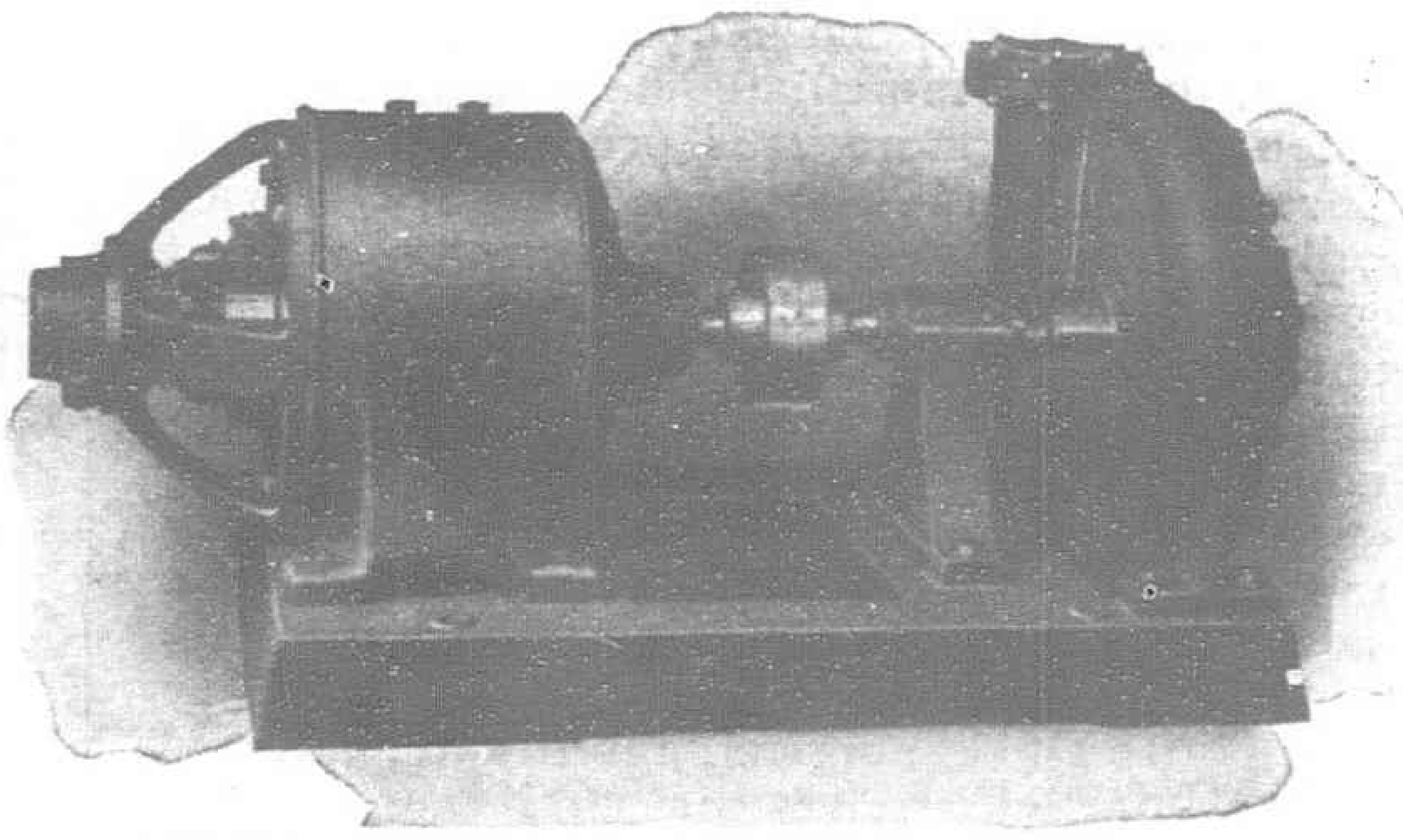
The Italians formerly also had a station in their settlement (concession) at Tientsin. That was discontinued, out of respect, they say, to the susceptibilities of the Chinese Government.

A NEW LINE OF CENTRIFUGAL PUMPS

The Goulds Manufacturing Company of Seneca Falls, N. Y., have just placed on the market an entirely new and improved line of centrifugal pumps. These pumps are furnished in both the single stage, single suction and single stage, double suction types. Either type may be arranged for belt drive or direct connection to electric motor, gas, gasoline or steam engines, steam and hydraulic turbines. The single suction, as well as the double suction pumps, contain many special features which are very important from an operating and economical standpoint.

The impeller in the single suction pump is of the open type. The vanes are carefully designed so that the maximum efficiency is obtained under normal conditions. The impeller is accurately machined to minimize the clearances between the impeller and the side covers. This feature has considerable influence upon the high efficiency which is obtained with this type of pump.

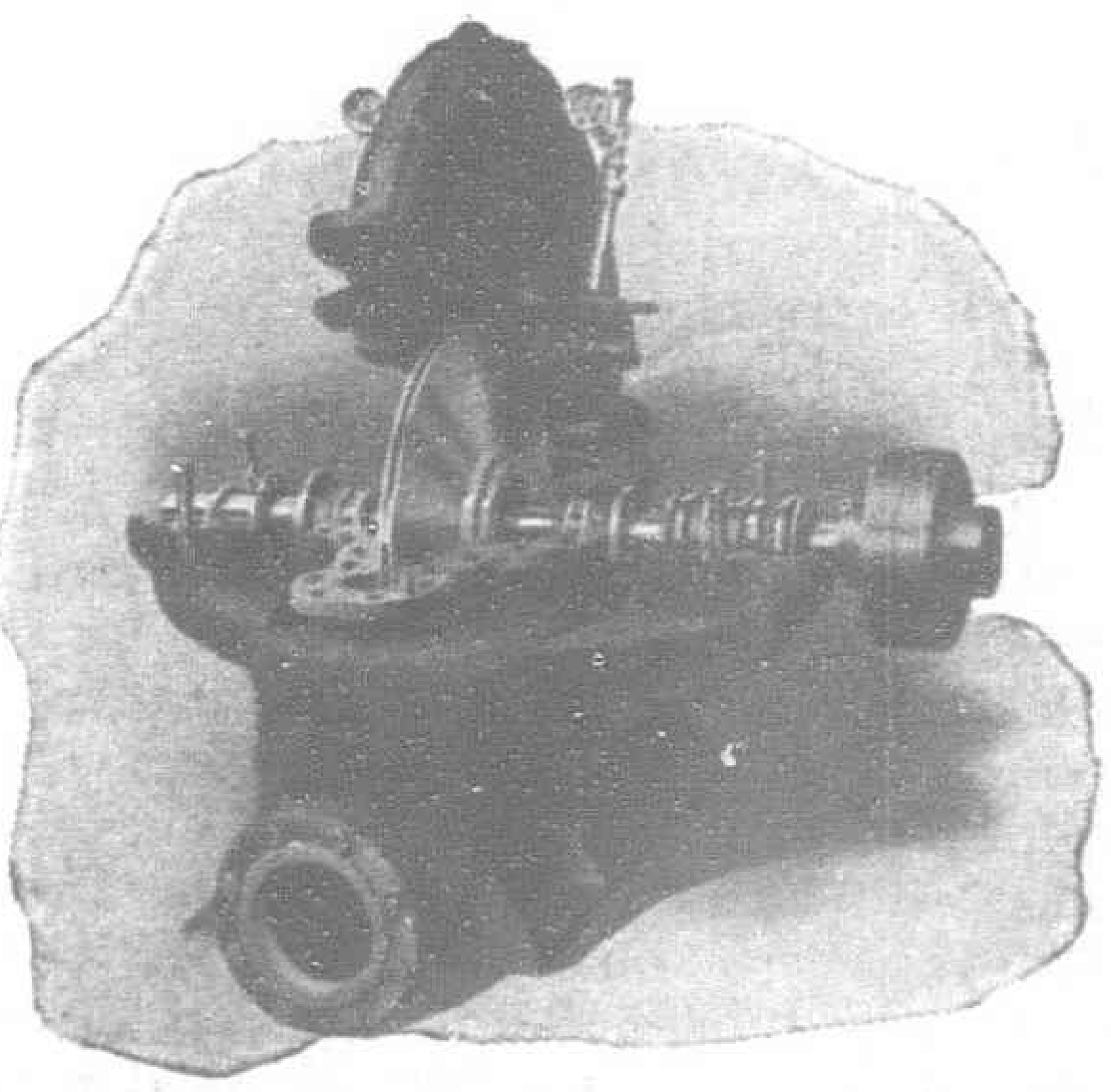
Although the single suction type, which in most cases means a considerable amount of end thrust, the impeller in the Goulds pump is designed in such a manner that this annoying feature is entirely eliminated.



SINGLE STAGE, SINGLE SUCTION GOULDS CENTRIFUGAL PUMP, DIRECT CONNECTED TO ELECTRIC MOTOR.

The stuffing box, through which the shaft passes, has a brass water sealing ring which prevents air being drawn into the pump at this point. Air will destroy the vacuum in a pump and impair suction.

The single stage, double suction centrifugal pumps are designed with a view of combining all mechanical details necessary to produce a centrifugal pump of the very highest grade. The casing proper consists of two castings bolted together on a horizontal joint. The purpose of dividing the casing is to permit quick and ready access to the interior parts of the pump for inspection, without disturbing the pipe connections. The impeller is of the most modern enclosed type and developes the highest efficiency under the conditions for which the pump is sold. The bearings are of the *ring oiling* type, independent of the stuffing boxes and they are provided with removable shells lined with the best quality of anti-friction metal. The stuffing boxes are provided with brass water sealing rings.



SINGLE STAGE, DOUBLE SUCTION GOULDS CENTRIFUGAL PUMP WITH CASE OPEN.

The double suction pumps are sold for heads up to 150 ft. while the single suction pumps operate against maximum heads of 100 ft.

The illustrations show one of the single suction pumps direct-connected to an electric motor and a view of the double suction pump with the upper half of the casing partially removed.

PHILIPPINE TIMBER FOR AN EMPEROR'S MAUSOLEUM

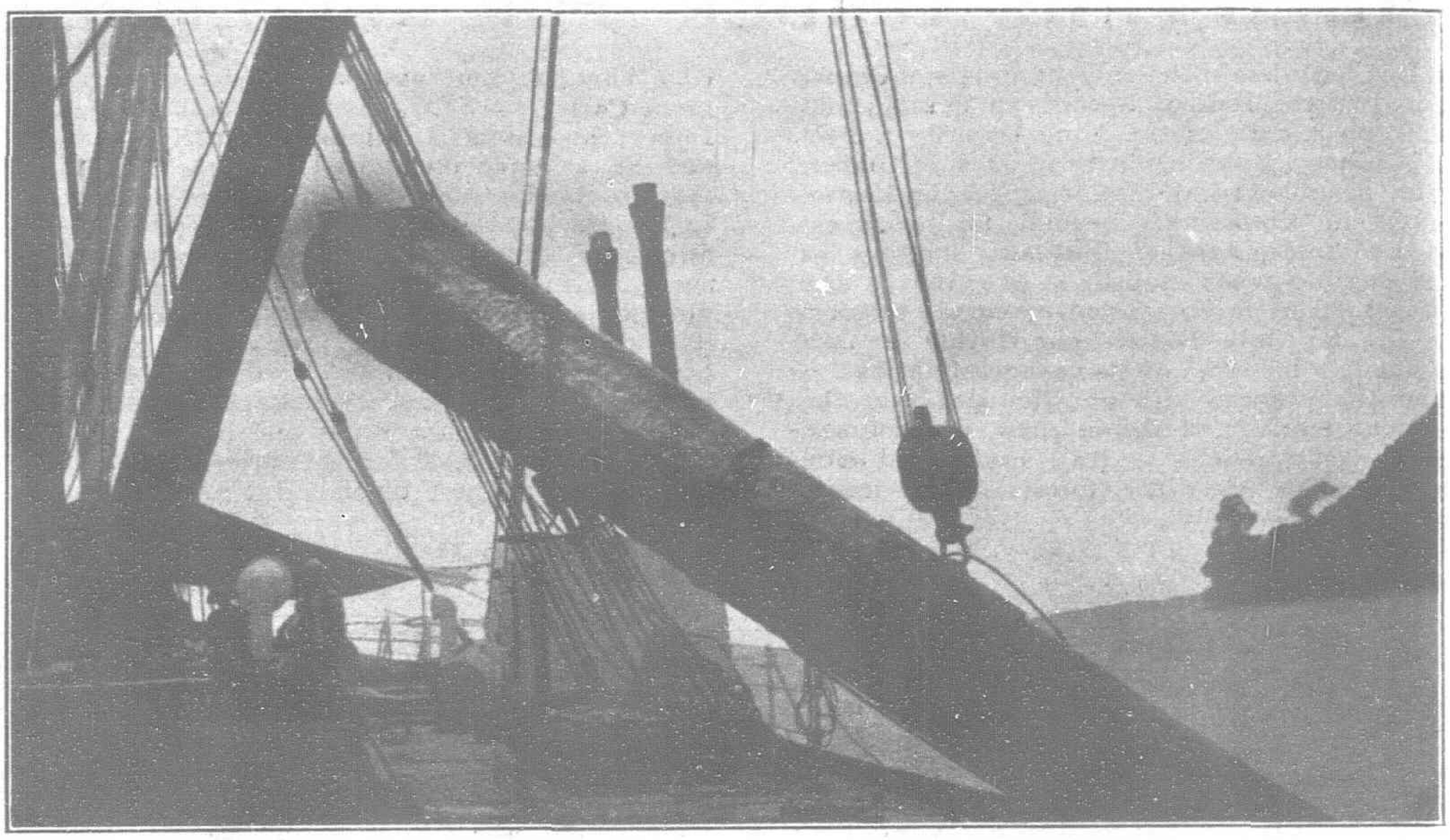
It is recorded in the ancient annals of China, stored in the Hall of Records in Peking, that once on a time in the Ming Dynasty a fleet of Chinese junks set forth in quest of timber, rare, beauteous and durable, fit for the Mausoleums of Emperors. Legend told of great girthed trees, hard as flint and lustrous as red marble when polished, growing in the fastnesses of fever-infested mangrove swamps in the far Sulu Islands, and thither the fleet ultimately laboured on its voyage of discovery. And that legend did not lie, and that the ancient mariner of China knew his courses, conquered his seas in frail craft, and won his treasure from the forests of the tropic isles is testified silently, eloquently and abundantly by the mighty beams and columns now supporting the Mausoleums of the Ming Emperors, freshened rather than depreciated by age, and hurling long sustained defiance at the ravages of time and the decaying influences of sun and storm, frost, hail, and snow.

Since that time the actual home of these great timbers has fled from the memory of man, and the romancers of the villages have woven wonderful stories from the fragments of fact which have leaked down through the corridors of time. The return of the fleet deeply laden with mighty logs that giants alone could lift dissolved from a stern reality into a mystic romance, and the silver-haired elder, bent of back and full of years, knows no better now than to repeat how his forebears went beneath the earth and hewed and wrested those pillars from among its supports.

And then an Emperor died. When the soul of Kwang-hsu, of the Manchu Dynasty, rode to the skies a while ago on the back of a dragon the nation realised that it must build a mausoleum no less adequate than those at the Tombs of the Mings, but where to get that same time-defying timber no living Chinese knew, but there was hope that a foreigner who was known in Peking could solve the difficulty. Chips were cut from the Ming Mausoleum and were taken to Peking, and there the foreigner was sought and questioned. That foreigner was an American citizen named Carl L. Seitz, Manager of the China Import and Export Lumber Company, Ltd., and he at once recognised the wood as being from the southern Philippine Islands. In his boyhood days he had penetrated the forests of the Philippines, and had seen such timber occasionally dragged from the noisesome depths of the swamps. He knew its haunts, its character, its choice of difficult surroundings, and the dangers to be run to obtain a quantity. But it could be got at a risk and a price, and he was willing to run the risk for the price he would name. The Chinese officials did not hesitate. He could name his price and they would agree so long as they had the timber. Mr. Seitz modestly asked what in the average lumber camp would be regarded as a fabulous sum, and without hesitation it was accepted, and, for the price, the American was called upon to pit his courage, energy, and knowledge against the forces of nature and the foibles of human physical structure. Undismayed by the fever, the poisonous insects and reptiles infesting the swamps, the great scarcity of the timber and the difficulty of transporting it to the seaboard when found and cut, Mr. Seitz set out with intrepid courage, taking with him two other

LOADING MONSTER LOG OF PAGATPAT ON THE S. S. HELLAS IN PHILIPPINE WATERS

PAGATPAT LOGS WON FROM THE MINDANAO JUNGLE, DESTINED FOR AN EMPEROR'S MAUSOLEUM



ANOTHER VIEW OF THE LOADING PROCESS

A MIDNIGHT MARAUDER OF THE MINDANAO JUNGLE

Americans, Messrs. H. Williamson, of Virginia, and F. Redding, of Texas, one of the men who went out for the fighting with Astor's Volunteers. And the timber was got.

With American aid and from American territory the wood for the desired Mausoleum ultimately came, the contract undertaken being to supply 338 pagatpat logs varying from 48 feet long and five to six feet in diameter to 20 or 30 feet with proportionate dimensions.

From Sibuguey Bay, on the south of Mindanao Island, the party, with a gang of Filipino labourers armed with sharp-edged bolos, plunged into the forbidding mangrove swamp, cutting and cleaving a way through the reeking undergrowth, threatened by crocodiles, and beset continuously by poisonous sea urchins, malaria-bearing anopheles and tormenting insects. The ravages of salt water rendered leather boots useless in a few days, and straw sandals alone offered frail protection from the flesh-tearing tangle of roots and branches, and the urchins which lurked beneath the soggy ooze. Shut out from sunlight and breathing steaming malodour, the party floundered on towards the solid land to the accompaniment of the ringing bolo and the savage curses of the struggling, stumbling, semi-naked natives carving the way ahead. Here and there the clean boled pagatpat pushed and shouldered through the dense growth to shake its crown of foliage in the purer air and sunlight high above, and each tree discovered was carefully examined and marked for future reference. Only the largest trees were selected, and most of these shot skyward straight as an arrow to the first limb some 60 feet from the ground, the bole being without flaw and of grain true as a die. All the trees grew in the swamps, those nearer the solid earth being older and larger than the others, and consequently increasingly dfficult to drag to the seaboard, some three miles distant. And even at the sea difficulties did not end for there was no harbour capable of taking a steamer of the size necessary for the transportation of the whole of the logs in one load.

Nature entrenched the valuable patagapat behind barriers such as would confound and defeat the resourceless man. But its fine-grained, chocolate-coloured, polishable wood was demanded for an Emperor's Mausoleum, and defeat was not in the scheme of reckoning of the men seeking it out. Buying the winch from the carcase of a steamer cast on the reef near Zamboanga, and connecting it with a condemned donkey-engine picked up in the same palm-fringed port, the improvised hauling gear was placed upon a raft and was towed 85 miles across the Celebes Sea—a feat of merit in itself—to the hole in the mangrove swamp whence entered the party on its first exploring expedition. And that hole was pushed into the steaming heart of the jungle, bolos cleaving the mangroves root and stem, till a canal three miles long had been made. Up this canal the raft was steadily pushed till the last corpse of the forest monarch was reached, and there hauling commenced. Suspended between dug out canoes 60 to 80 feet long, the unfloatable logs were dragged stage by stage to the lapping sea, and journey after journey was made, the wire hawser, the winch and the patience and endurance of the human enduring till the last of the 338 was landed in the sunlight. Then another feat had to be accomplished. No harbour could be found for the chartered steamer Hellas, nearer than Buluwan Island, sixteen miles off, and across this span of sea log after log had to be towed in the calm waters of early morning, the slightest breeze rendering transportation dangerous owing to the heaviness of the timber and the frailty of the supporting canoes. Six of the largest logs went to the bottom in fourteen fathoms of water owing to the canoes filling in a blow, and those logs are still among the blind eyed snakes and dank sea growths. But the qualities which invariably win out triumphed in this as in other difficult enterprises, and between May and November of last year the whole of the work was accomplished, there being on the 20th of the latter month a dead weight of 4000 tons of timber in the holds or on the deck of the steamer Hellas, ready for transportation to China. Logs weighing up to 21 tons each were skilfully handled by natives who had never before seen a steamer, and although all wire and hempen hawsers broke in turn only one accident of note occurred—an accident which might well have put a period to the usefulness of the Hellas had the hold been empty—for one of the heaviest logs broke its hawsers whilst in mid-air and in its descent to the hold broke in half the huge log it fell upon and badly split a second one against which it pounded. Vivid imagination is not needed to indicate what might have happened had one of the earlier logs fallen upon the unprotected bottom of the steamer.

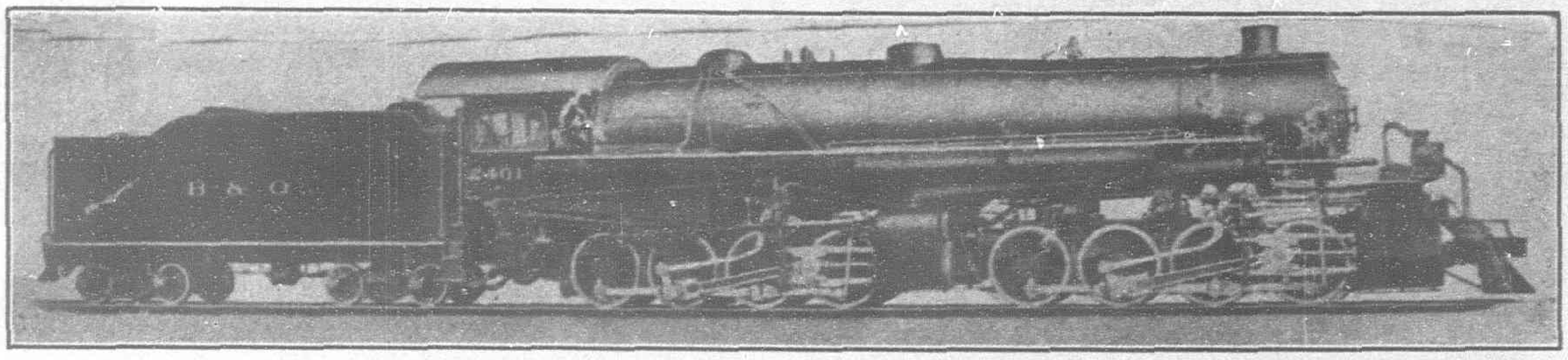
Difficulties of the sort related, however, were nothing in comparison with those encountered by the humans from fever and poison, and at times all the camp were sufferers, and some mortally so. The laborers constantly fell victims, and at one period the whole of the crew of the steamer, officers included, were attacked with malaria. Natives succumbed and white men fared badly throughout the sojourn in the jungle, and to cap the series of troubles Mr. Seitz himself was on the verge of death from blood poisoning caused by a scratch from a sea urchin on the foot. Careful nursing by an American nurse and strength of constitution of the sufferer overcame the terrors of the malady, but Mr. Seitz is still unable to use the injured limb properly. He escaped where others have succumbed, however, the latest victim being an American army surgeon who was scratched whilst crossing one of the swamps, and the money paid for the logs by the Chinese Government will scarcely compensate for permanent injury to a leg or for the loss of life and injury to constitution entailed in getting them out.

Those logs are now at Hai-ling, the site of the Emperor's tomb, 75 miles south of Peking, and about the same distance inland from the line running to Hankow, and there they were got from Chinwantao—where they were unloaded from the steamer—by railway.

The Mausoleum of the Empress Dowager, who died about the same period as the Em-

ARTICULATED COMPOUND LOCOMOTIVE OF THE AMERICAN LOCOMOTIVE COMPANY

In 1910, American railroads curtailed their locomotive buying as much as possible; the significance, therefore, of this figure as indicating the growing faith in the articulated locomotive will be readily understood.



230-TON ARTICULATED COMPOUND LOCOMOTIVE

Built for the Baltimore & Ohio Railroad

GENERAL DIMENSIONS

Gauge of Track	4 ft. 8½ in.	Fuel	Bituminous Coal
Maximum tractive power, compound	105,000 lbs.	Boiler pressure	210 lbs.
Maximum tractive power, simple	126,000 lbs.	Weight on driving wheels	461,000 lbs.
Heating surface, fire box	321.5 sq. ft.	Wieght, total of engine	461,000 lbs.
Evaporating heating surface, tubes	5205.5 sq. ft.	Weight, total of engine and tender	642,500 lbs.
Total evaporating heating surface	5527 sq. ft.	Extreme height	15 ft. 6 in.
Superheating surface	1002 sq. ft.	Extreme width	11 ft. 6 in.
Grate area	100 sq. ft.	Length over all	93 ft. 3⅜ in.

Since its installation in 1904, the original Baltimore & Ohio articulated compound locomotive has been operated in pushing service on the Connellsville Division between Rockwood and Sand Patch, 16 miles. The track is exceedingly crooked, having seven curves of seven degrees. The maximum grade is 1%. In the Rockwood yard, the curves are even worse than on the road. With one consolidation at the head, the articulated locomotive handles a train of 2,200 tons on the above grade at a speed of 18 miles an hour. It does the work of two consolidation locomotives in pushing service, at a saving in the cost of maintenance alone of 38%; as shown by the following figures from records:

From January 6th, 1905, to December 31st, 1910, the total cost of repairs to the articulated locomotive, including running and classified repairs, per actual mile run was 11.07 cents, the corresponding aggregate figure for the two locomotives which it replaced was 18.2 cents per the same unit. This is based on the average for 13 consolidation engines in identically the same service as the articulated locomotive for a period of two years.

This locomotive is in operation 24 hours a day, running forward up the hill and backing down, and is never turned. It has been necessary to make all running repairs at a terminal having only one machinist and one boilermaker, a sure indication that little attention has been required in the matter of running repairs.

With the track conditions previously mentioned, an exceptionally good opportunity has been afforded to determine whether there was any tendency toward excessive flange wear due to the wheel arrangement. Careful comparison between the articulated and consolidation locomotives in the same service shows that the former makes about four times as much mileage as the latter between tire turnings necessitated by flange wear. The articulated engine made 47,234 miles for the first set of tires, while the consolidation locomotives make an average of only 10,000 to 12,000 miles.

In the matter of wear in the valve motion, it has shown a marked advantage as compared with the consolidation locomotives. In 4,454 miles, the lost motion in the valve gear of the articulated engine was $3/64$ in., as compared with ½ in. for the consolidation locomotives for an equal length of time and measured in the same way.

No trouble has been experienced with the flexible joints; and practically no attention has been necessary to keep them in repair.

In the matter of boiler repairs, the record of the articulated locomotive has been exceptional. It still has the same fire box with which it was equipped when delivered seven years ago.

For the six years from January 6th, 1905, to December 31st, 1910, it was available for service 40,011 hours out of a possible 50,343, or practically 80% of the total time.

The Baltimore & Ohio officials freely admit that in reliability, cost of repairs and fuel consumption, per unit of work done, it is one of the best engines on the road.

The locomotives illustrated in these columns will operate on the division between Cumberland and Grafton. They will be used in pushing service, part of them on the six-mile grade East out of Newburg, and the remainder on the 12-mile grade between Rowlesburg and Cranberry. On the former grade, the steepest rise is 2.27%; while on the latter the ruling gradient is 2.2 combined with uncompensated curves of 12 degrees. There are also reverse curves of 9.5 and 4.5 degrees on this grade.

Though the sharpest curves on the road are 12 degrees, the locomotives are built to pass curves of 20 degrees in the yards and terminals.

They are designed to handle a train of 1,750 tons on the ruling grade with a Baltimore & Ohio Class E–19–A consolidation locomotive, rated at 475 tons, at the head. This leaves 1,275 tons to be moved by the pusher.

In actual service, these later engines have exceeded their theoretical capacity by a considerable margin.

On a recent occasion, locomotive 2405, with a Baltimore & Ohio consolidation locomotive rated at 475 tons, handled a train of 2,032 tons on the 2.01% six-mile grade from Newburg to Kingwood tunnel. The articulated locomotive pushed 1,557 tons.

The locomotive was stopped by a flag on the worst part of the grade for five minutes, after which, it easily started the train when thrown into simple working. The six miles were made in a total time of 47 minutes, including the five minutes' stop, making the actual running time 42 minutes.

The load pushed by locomotive No. 2405 was 132 tons more than three consolidation

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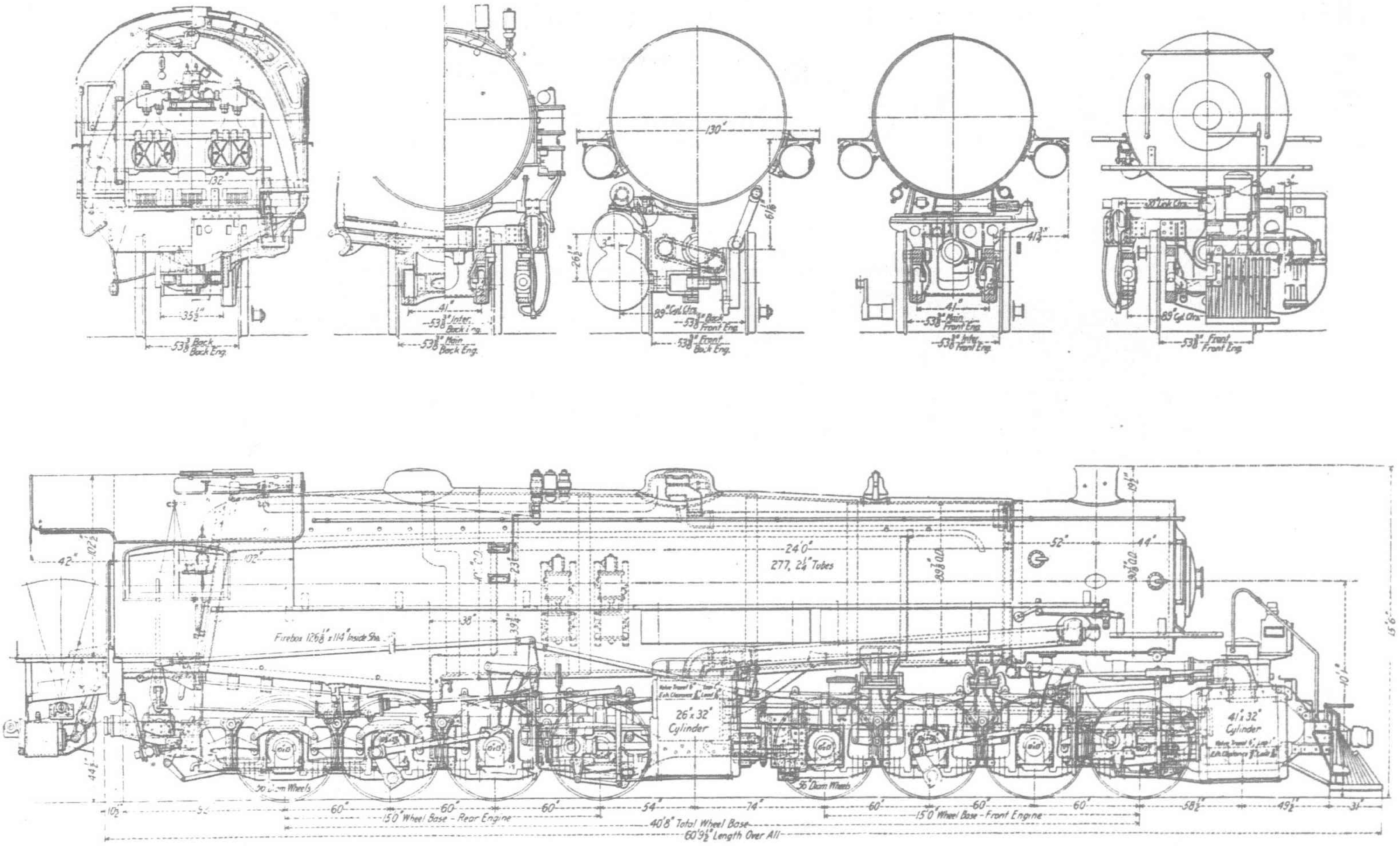
peror, was built by the "Old Lady" herself from timber procured from the Celebes during her lifetime, and she spent upon her last resting place about four million taels (Taels 4,000,000). It is not far from where the late Emperor's Mausoleum will be, but the latter will only cost about 2,000,000 Taels at most, though of similar design. The grave of the Emperor—where reposes the coffin—is hewed from solid rock in a hill side, and one-third of a mile from the grave is the main gate of the Mausoleum. The foundation of the Mausoleum is of stone with white marble tiles and railing, all being carved with the five-clawed dragon design (similar to that of the Temple of Heaven). The tiles and steps are all laid in odd numbers, the Chinese being superstitious of even numbers. The Mausoleum itself is supported on four main columns 48 feet high and five to six fect in diameter, and numerous other minor columns. Twenty-four of the largest logs have been, or will be, used as cross-beams, and will weigh on an average 16 tons each, one being as much as 21 tons. These logs will be hauled into place and fitted into sockets without being fastened, so designed as to resist the effect of earthquakes and render the Mausoleum permanent for all time. Around the Mausoleum will be a moat, and residences for the official caretakers. Across the moat fronting the Mausoleum will be five marble bridges, two on the outside for the use of those in charge, the three centre ones for visitors. Of the latter three the middle one is for the Royal family and the other two for distinguished visitors at times when worship is proceeding. A spur railway has been built from the main Peking-Hankow line to the tombs and so they may be reached easily at certain periods, and are likely to be the object of curiosity to tourists when China is further opened to the travelling public ofthe world.



SIDE ELEVATION AND CROSS SECTION OF THE 230-TON ARTICULATED COMPOUND LOCOMOTIVE BUILT FOR THE BALTIMORE AND OHIO R. R. BY THE AMERICAN LOCOMOTIVE CO.

locomotives, having an aggregate tractive power of 124,800 pounds, had ever been able to handle on this grade; though the articulated locomotive are rated at a tractive power of only 105,000 pounds.

In the characteristic features of the type, these later engines follow the builders' practice established in the first Baltimore & Ohio articulated locomotive, which speaks well for the care with which the details were originally worked out.

Apart from the enormous increase in weight, the most important change from the previous locomotive was the application of a superheater. This is of the fire tube type. designed to give a high degree of superheat.

Recent tests have demonstrated the value of the superheater for this type of locomotive.

Though the boiler is the largest ever built in which all the heating surface is utilized for evaporation, its design is in accordance with ordinary practice, except for the superheater; and embodies no new or unusual features.

It incorporates a 38-inch combustion chamber, and the tubes are 24 feet long.

Because of the application of the superheater, a different arrangement of high pressure steam pipes from that used in the former design was necessary. This arrangement is shown in the illustration of the side elevation.

Another modification from the previous engine is an inside reach rod for the valve motion of the forward engines, extending along the center line of the engine and having a universal joint connection with the main reverse shaft. The flexible joints, sliding boiler bearings, spring centering device and power reversing gear are of the same construction as in the first articulated locomotive.

PROSPEROUS YEAR FOR J. G. WHITE & Co.

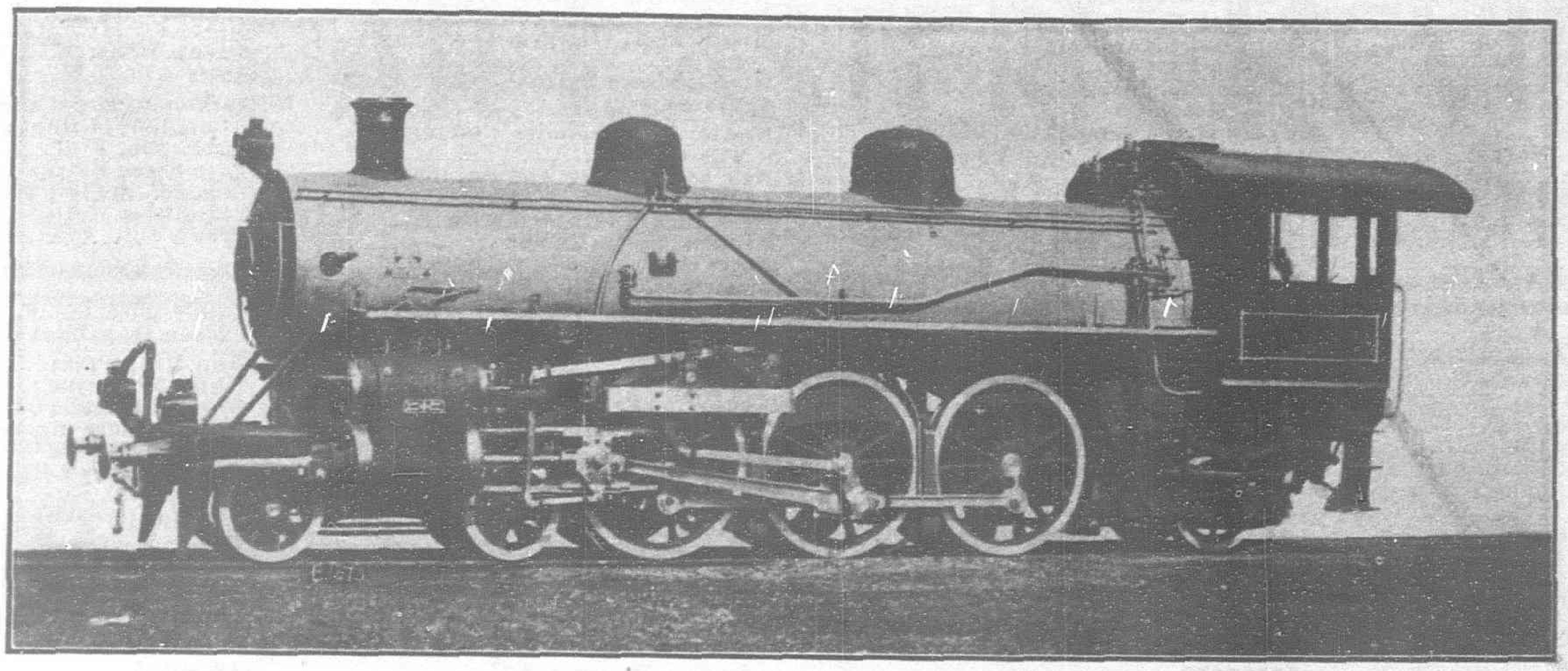
The annual report of J. G. White & Company, Limited, of London, recently presented at the Company's Twelfth Ordinary General Meeting by the Chairman, Mr. J. G. White, shows the phenomenal success of an engineering firm of American origin, though operating entirely as a British company. The English company is the direct outcome of the successful operations of J. G. White & Company, Incorporated, of New York in foreign territory. Organized in 1900, the English company was equipped to undertake the largest problems in the field of consulting, designing and supervising engineering and construction as well as the operation of Public Service properties and participation in financing such properties.

The English company has this year declared a total dividend of 12 per cent on its preferred stock and 62 per cent on its common stock, after which the net earnings for the year have been sufficient to write off the balance of "Purchase of Business" Account and increase the special reserve and surplus account to an amount equaling the total dividends paid. This has been done after making ample provision for contingencies and without writing up the value of securities owned. Some of these securities have increased materially during the year, so that even greater profits were actually made, although not realized, and, consequently, not considered as earned. The market value of the ordinary shares, par value £1, has increased from £1 6s in 1906 to £7 4s in 1911.

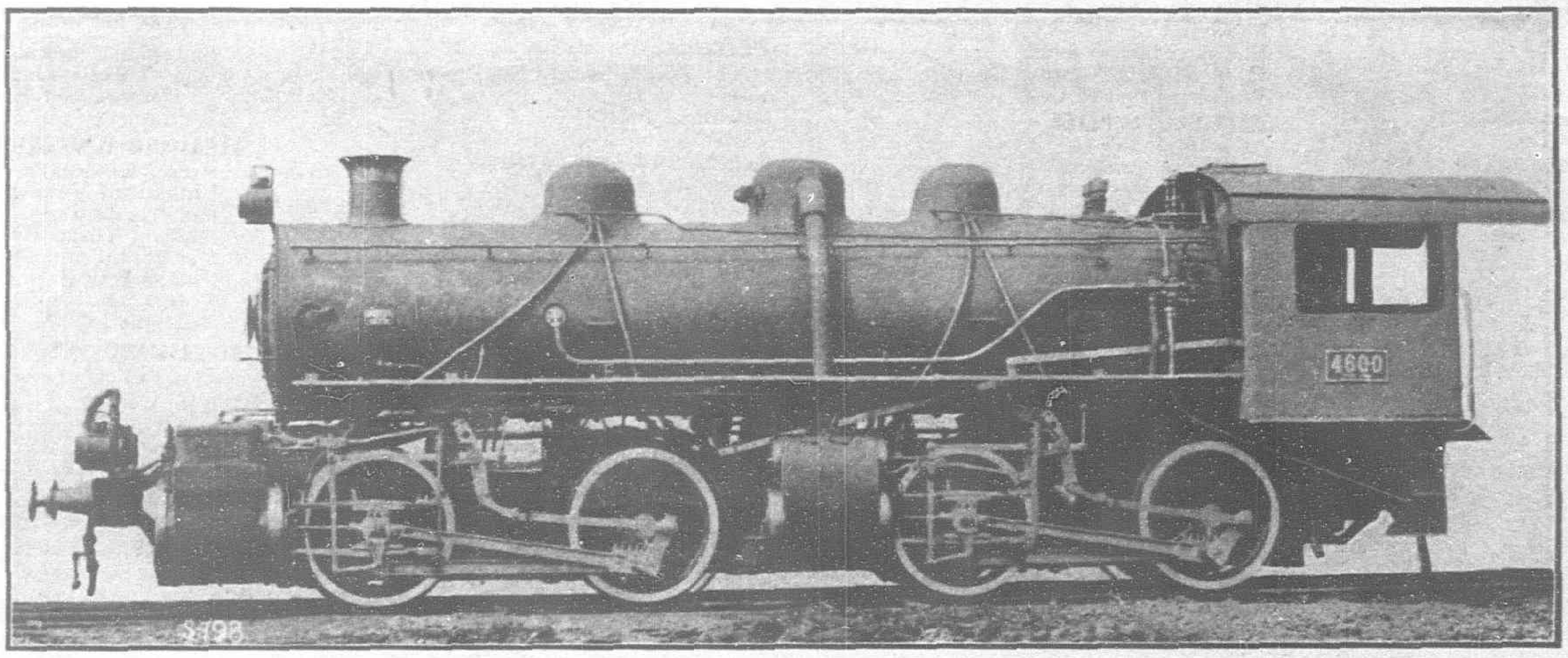
The Chairman in his report stated in part:

"The net profit for the year amounts to £91,466 as against £64,801 for last year; the quick assets of the Company in the form of cash and loans against securities, amount to £135,381, an increase of about £18,000 over the figures shown in the preceding year. This quick-asset item is nearly double the total single-creditor item on the other side of the balance sheet. The figure for investments stands at £150,781, which is also considerably more than twice the Company's total debts. This item shows an increase of approximately £28,000 over last year.

"During the ten and one-half years of the Company's life, including the distribution recommended in the report, the Company will have paid out in dividends £160,708 and has retained in the business out of profits, £182,787. The directors believe in continuing the policy of building up reserves and therefore propose that of the sum of £85,813 now available for distribution, £15,000 be allocated to writing off the balance of purchase of business account and a further £15,000 be placed to the credit of a new reserve account for the equalization of future dividends. This total sum of £30,000 having been set aside, your directors recommend a dividend of 7% for the half-year on both the preferred and ordinary shares, making, with the interim dividend of 5% paid January 1st, a total distribution of 12% for the year. As you know, the preferred shares are accumulative as to 6% and therefore they share with the ordinary up to a total distribution of 12%, the ordinary being entitled to remaining surplus profits. We further recommend an extra dividend of 10 s. per share or 50% on the ordinary shares, making a total of 62% for the year, leaving the balance of £19,812 to be carried forward to next year's accounts."



Class 462-137 Locomotive, Built by the American Locomotive Company for the Imperial Government Railways of Japan. Road Number 8606—Gauge of track, 3′ 6″; Cylinders—Diam. 18.½, stroke, 24″, Driving Wheel diameter, 63″; Boiler-diameter 56″, pressure 180; Fire Box—length, 72.3|16″, width, 54 ¼; Tubes—number, 16, with diameter each of 5½, and 99 with diameter of 2¼″, length 16′ 3″; Wheel Base—driving, 11″-0″, engine, 29′-0″; Weight in pounds, working order—leading, 33500, driving 79500, trailing, 23500, engine 136,500; Fuel, soft coal; Heating surface in sq. feet—tubes, 1314, fire box, 95, total 1409, superheater, 280; grate area 27 sq. feet; Maximum Tractive power 19,900 lbs.; factor of adhesion, 4.



Class 0440 C 132 Locomotive, Built by the American Locomotive Company fo the Imperial Government Railways of Japan.—Road Number 4,600. Gauge of track, 3′-6″; Cylinders—diameter, h. p. 15½″, l. p. 24½″, stroke 24″; Driving Wheel Diameter, 49″; Boiler—diameter 59 1|8″, pressure, 180 lbs; Fire Box—length 103 3|16″, width 29 ¾; Tubes—number, 176, diameter, 2 ¼″, length 15′-0″, Wheel base-driving 7′-0″ & 2′-0″, engine 22′-8″; Total weight in working order, driving, 131500 lbs., engine, 131500 lbs; fuel, soft coal; Heating surface in sq. feet—tubes, 1546, fire box 117.8, total 1663.8; Grate Area, 21,4; maximum tractive power, 27500 lbs.; factor of adhesion, 4 78.

*LONDON METAL MARKET

AUGUST 11, 1911.

COPPER.	£ s. d.	£ s. d.
*Tough cake and ingot	60 5 0	60 15 0
*Best selected	60 5 0	60 15 0
*Electrolytic	60 10 0	61 0 0
*Sheets and sheathing	71 0 0	—
*Flat bottoms	74 0 0	—
*Copper tubes, seamless per lb.	0 0 8½	—
*Lake	60 15 0	61 0 0

* Less 3½ per cent. † Net.

ALLOYS.		
Brass: Wire	0 0 6¾	—
,, Tubes (solid drawn)	0 0 6¾	—
,, Sheets	0 0 7¼	—

*Mining Journal.

TIN.		
English ingots, f. o. b.	190 0 0	191 0 0
,, bars	191 0 0	192 0 0
,, refined	192 0 0	193 0 0
Banka (in Holland) Cash	191 15 0*	—
	—	—

*Close of market for prompt.

LEAD.		
English pig, L. B.	14 10 0	—
,, sheet and bar lead	15 12 6	—
,, pipe	16 2 6	—
,, red	16 10 0	—
,, white	19 5 0	—
,, patent shot	17 0 0	—

ANTIMONY.		
Antimony Crude	11 5 0	12 5 0
,, Ore (basis 50%)	7 5 0	7 15 0

ALUMINIUM.	Per ton.	Per ton.
98-99 per cent.	60 0 0	61 0 0

NICKEL.	Per ton.	Per ton.
98-99 per cent. guaranteed	167 10 0	171 0 0

PLATINUM.

Per oz. Troy, 172s. 6d.; nominal and subject to negotiation.

MANGANESE ORE.

Ore c. i. f., U. K. ports.	Per unit.*	
Indian or Brazilian, 50 per cent.	£0 0 9¼	to £0 0 9½
,, ,, 48 ,,	—	9 0 9
,, ,, 45 ,,	—	0 0 8½
Caucasian 50 per cent.	—	0 0 7¾
,, 48 ,,	—	0 0 7½

*Unit corresponds to 1 per cent.

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